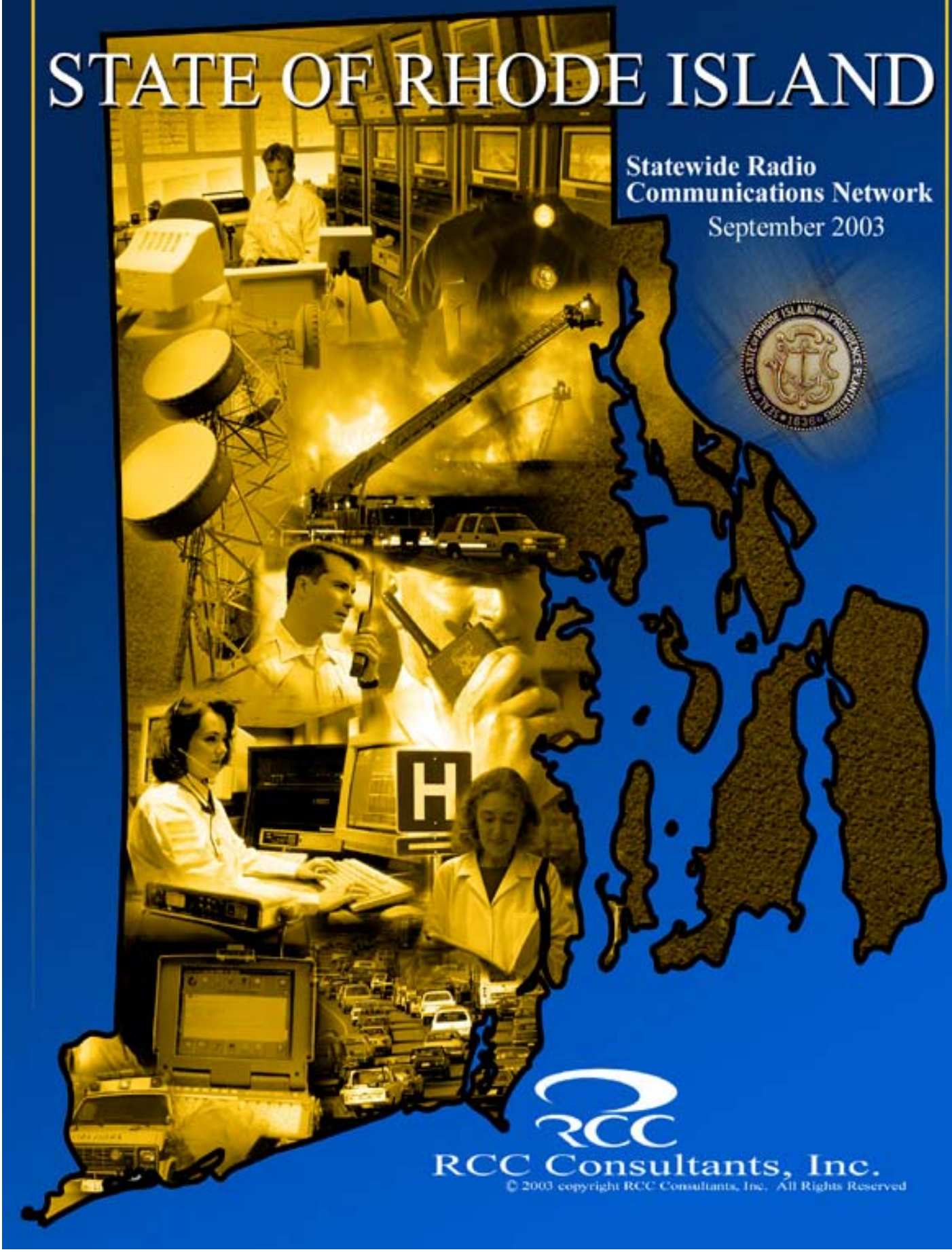
STATE OF RHODE ISLAND

Statewide Radio Communications Network

September 2003



RCC Consultants, Inc.

STATE OF RHODE ISLAND

STATEWIDE RADIO COMMUNICATION NETWORK

FINAL REPORT

ASSESSMENT AND RECOMMENDATIONS

NOVEMBER 17, 2003

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1.0 EXECUTIVE SUMMARY

INTRODUCTION

In 1996, RCC Consultants, Inc submitted a system consolidation report to the State of Rhode Island entitled 'The Rhode Island Communications Integration Analysis'. The study reported on the feasibility of merging existing fractured radio systems, and migrating to a common frequency band utilizing advanced-technology architectures. It examined management theory on consolidation, discussed what technology is being provided, and showed how a shared or consolidated system could work. The analysis was an opportunity for state radio planners to learn from the experiences of others - what has worked, what has not worked, and why.

The State of Rhode Island has not been idle in its desire to create a new public-safety radio network and some key recommendations were implemented. However, recent events, which includes the September 11, 2001 World Trade Center incident, and recently the Station fire in West Warwick, has re-focused state radio planners to address critical communication needs of public safety responders statewide.

Rhode Island radio planners wish to create a SRCN [Statewide Radio Communications Network] that will enhance radio communications for public-safety in emergencies. There are four core State agencies, each of these agencies currently has their own statewide radio networks:

- Department of Transportation,
- Rhode Island Transit,
- Rhode Island State Police; and,
- Department of Environmental Management

In addition to acting as a public safety network, the SRCN could be used as a backup to an emergency Health Alert Network used to connect relevant entities such as CDSTARS, Hospitals, Labs, Schools, E-911, Dispatch Centers, Government Administration Departments and potential other "first responders." The State envisions the SRCN to be robust enough to handle day-to-day communications among the core agencies in addition to the emergency traffic generated from other relevant state and local public safety organizations.

To facilitate the design of the SRCN, the State seeks to retain the services of a qualified public safety communications-engineering consultancy to perform a system needs analysis and to make recommendations. The System Needs Analysis must assess the current radio systems as well as to analyze future expansion plans. The State seeks to assimilate the best options and recommendations for a SRCN.

This document reports on the findings and assessment of current communication networks in Rhode Island and makes recommendations for migration to an integrated advanced-technology communications system.

MAJOR FINDINGS

Assessment

- Rhode Island public safety agencies utilize several frequency bands for radio communications, including VHF highband and lowband, UHF and 800 MHz;
- There are diverse radio systems in use statewide, these include digital, analog, conventional and trunked networks
- There is an estimated 7,321 subscribers [mobile and hand-held portables] in service statewide
- A leased radio service from Nextel is widely used, more than 2,000 public safety units statewide.
- Radio planners indicate their three [3] major communications problems are: [1] lack of functional interoperability; [2] insufficient operating channels; and, [3] the need for improved signal coverage
- There are interoperability problems at all levels: on-scene and agency to agency communications; this is due to crowded channels and dissimilar frequency bands
- Most department reports that they have insufficient radio channels, especially during emergencies
- The police and fire statewide Intercity radio channels are saturated when needed
- EMS utilizes cellular telephone for hospital communications; DOH is currently re-commissioning the HEAR [Hospital Emergency Administrative Radio] dedicated VHF radio system for ambulance to hospital communications.
- DEM operates radio systems in two different frequency bands: VHF Lowband and VHF Highband
- DOH utilizes Nextel services for primary communications
- RISP receiving co-channel interference on critical channels
- There is duplication of 800 MHz technology-based radio networks: RIPTA, RIDOT, and RIDOC
- RIPTA and RIDOT have Motorola 800 MHz Smartnet Simulcast Trunked Radio Networks
- RIDOC has a Uniden 800 MHz LTR Trunked System that is not compatible with the RIDOT and RIPTA networks
- 75% of law enforcement and fire services use VHF channels, approximately 25 % use UHF frequencies
- All agencies report on the need for enhanced signal coverage, especially for hand-held portables and inside of buildings
- Most agencies expressed the desire for features provided by technology-based radio networks
- The law enforcement mobile data network CDPD backbone leased from Verizon will be discontinued in 2005 – there are currently over 500 users statewide

- These is a need to expand mobile data to non-law enforcement agencies, such as fire and EMS
- The State Police microwave network is the predominant statewide backbone and is approaching full capacity at some nodes
- The State Police microwave network will soon be no longer supported by the vendor – fast becoming obsolete
- Existing communication facilities – towers and shelters - have been upgraded in recent years and are state-of-the-art
- An inter-agency net, RITERN, is being implemented on the DOT trunked radio network for additional interoperability during emergencies among all state agencies or departments
- There is sufficient 800 MHz spectrum for the four [4] core agencies; however, there is insufficient allocation for a statewide network
- DOT channels can not be expanded to other sites due to FCC allocation policy
- 700 MHz spectrum not available until 2010 – current estimate
- Washington County[1] has recently received a $3.1-million Federal grant to implement a countywide 800 MHz Project-25 trunked radio network; use this network as the platform for a statewide network

Recommendations

- Continue to build and expand the RITERN Network
- Seek additional 800 MHz spectrum for system expansion
- Implement Washington County 800 MHz Project-25 system

  ~Estimated cost range for portable in-building coverage: $6.0 – $7.2-million
- Begin planning and designing a new statewide Mobile Data Network for 1,000 users

  ~Estimated cost range for Mobile Data Network: $4.62 – 7.65-million
- Build out the National NPSPAC I-TAC channels statewide

  ~Estimated cost range for NPSPAC ITAC: $140,000 - $175,000
- Begin planning for a statewide 800 MHz network backbone using RITERN and the Washington County Project-25 network as the platform for expansion; additional radio sites are needed for portable in-building coverage, which will include new towers, shelters, etc.

  ~Estimated cost range $20.9 - $25.4-million

[1] On August 1, 2003, the Town of Narragansett Police Department submitted to the DHS Emergency Preparedness and Response Directorate, a request for funding a multi-jurisdictional interoperable communication network for Washington County. Gov. Donald L. Carcieri chose the Town of Narragansett to head this important project due to the lack of interagency communications in the southern part of the state. The grant was approved by DHS and the County was awarded $3.1-million to construct a countywide technology-based 800 MHz trunked network to provide interoperability among the various towns located in the County. Furthermore, this network will interface with the State's newly created RITERN Network linking key public safety and health departments on a common communications net, thus providing the County with a fully interoperable network. RI is planning to utilize this network as the platform to provide enhanced interoperable communications statewide.

- Upgrade and expand inter-site linking microwave network

  ~Estimated cost range for expanded/upgraded microwave system: $5.54 - $7.31-million

- Add Core Agency Subscriber radios to network [1,005 units]

  ~Estimated cost range to add Core Agency subscribers: $3.21 - $3.72-million

- Add all state and local agencies\departments to network as spectrum allows [5,336 units]

  ~Estimated cost range to add all state/local agencies: $17.1 - $19.7-million

- Standardize new radio equipment purchases to ensure statewide network compatibility that will ensure inter-agency interoperability: Dual Band [700Mhz\800 MHz] Project-25 Radios

- Estimated budgetary cost to implement all recommendations for an integrated statewide public-safety mobile radio and data communications network for all state and local agencies:

  ~Estimated cost range $57.5 - $71.1-million

NEXT STEPS

To build a statewide communication system, Rhode Island must take decisive action to pursue a shared communication infrastructure that is accessible to all interested public safety agencies statewide. More importantly, to appropriate long-term funding commitment to implement the proposed network. The lack of action will deteriorate interest and fail to move the project forward.

The following steps will establish a firm direction for the future of a statewide radio network in the State of Rhode Island. These steps are necessary to ensure that radio communications will effectively support the delivery of public safety services well into the 21st century.

1. **Develop a strategy for system funding and finance**
   Successful multi-year migration to a statewide network will require significant investments in the system infrastructure. Identify appropriate sources of capital funding and finalize financing arrangements for the system.

2. **Identify additional 800 MHz spectrum**
   Work with the Region-19 RPC to identify supplementary 800 MHz channels that may be available to Rhode Island. Additional channels will allow the State to implement their system more quickly without having to wait for 700 MHz channels that will be available in the distant future.

3. **Institute a Multi-Agency Governance Structure**
   This formal decision-making body should be established to provide the required oversight and to guide the lead agency that will manage the construction and operation of the proposed network. A project manager should be selected to provide guidance of the selected vendors of the statewide communication system. The project manager would be directly responsible for implementation and would be the communications conduit to the governing structure.

4. **Finalize network design**
   To plan and support the final development of the new system, the State should seek participating agency input for the system design and the development of policies for the proposed network.

5. **Competitive Procurement Process**
   The State should develop single/multiple Requests for Proposal [RFP] for equipment and system procurement by developing detailed functional specifications for the statewide communications network.

6. **Obtain Outside Technical and Support Assistance**
   The State should seek outside specialized skills to assist the State's project manager in finalizing the technical design, the development of technical specifications, and to provide project management support.

REPORT STRUCTURE

1. **Section-1 - Executive Summary**
   Provides a high level review of the project, its findings, and assessment

2. **Section-2 – Project Goals and Strategic Plan**
   Summarizes the objectives, purpose and goals of the project

3. **Section-3 – Current Environment**
   Brief discussion and analysis relating to current spectrum, technology, and operational issues of each State agency

4. **Section-4 - Findings**
   A discussion of crucial communication issues and problems currently faced by public safety agencies.

5. **Section-5 – Issues Affecting the Proposed Network**
   Discussion topics relating to NPSPAC channels, recent FCC activity, spectrum issues and policies, and channel loading consideration.

6. **Section-6 – Conceptual System Design/Migration Roadmap**
   Provides a high level design over-review and migration strategy for the proposed 800 MHz advanced-technology statewide voice and data radio communications network.

7. **Section-7 – Estimated Budgetary Costs**
   Identifies and breakdown the proposed budgetary cost.

8. **Section-8 – Multiple Agency System Governance**
   Discussion on multiple agency network governance and cost apportionment

2.0 PROJECT GOALS AND STRATEGIC PLAN

The State of Rhode Island Communications Working Group [CWG] envisions improved wireless communications capabilities among the four core State agencies, which include the Department of Transportation [RIDOT], Rhode Island Transit [RIPTA], Rhode Island State Police [RISP] and the Department of Environmental Management [RIDEM]. Each of these agencies currently has their own independent statewide radio networks.

The vision is to provide a long-term sustainable solution that supports the various public-safety missions by maximizing resources; leveraging existing RF infrastructures; employing the correct technology architecture based on FCC initiatives and mandates; and most importantly, to comply with Rhode Island radio user requirements.

The Rhode Island project is divided into two phases. The major project milestones for Phase-1 of the project include data collection, and an assessment of the current agency based radio systems. Phase-2 of the project includes recommendations for a statewide radio network. The purposes of this report is to:

1. Conduct personnel interviews to discover agency requirements for a statewide radio network
2. Identify the interoperability requirements of each agency
3. Assess each of the major statewide radio systems currently in use
4. Identify potential voice and data communications technology and operating spectrum
5. Provide migration roadmap for successful implementation.

Specific Task Requirements

The State of Rhode Island has undertaken radio communications interoperability for the SRCN, and has requested the services of RCC Consultants, Inc., a communications consulting company, to analyze needs and to make recommendations for improvement as well as future needs. The study takes into account evolving technology, interoperability requirements, and existing and future FCC authorizations.

The objective of this report is to provide the State CWG officials information addressing the following issues:

- service deficiencies and needs not currently met by the existing system[s];
- desirable functions and features of an upgraded system;
- planned future applications, uses, and operational changes;
- system reliability and availability issues;
- system capacity and coverage performance requirement;
- recommendations for system improvements, upgrade or re-design.

Data Gathering Process

To ensure that a comprehensive assessment will adequately consider the needs and the requirements of the state's public safety community, RCC conducted a complete review of the current radio systems used by the core state agencies, as well as others. This section defines the status and performance of the current radio systems based on user documented specific communications needs. This was accomplished using a comprehensive questionnaire that was distributed to, and completed by representatives of various State organizations utilizing radio communications, as well as those who currently do not have radio networks, but require this function in an unusual event or mass casualty.

Personnel interviews were conducted with system users to discuss operating philosophy and organizational needs. Where possible, RCC collected existing network documentation to understand how major functions are performed.

The participating Department and Agencies are identified in the table below.

- RI State Police
- Department of Environmental Services
- Department of Corrections
- Department of Health
- Department of Transportation
- E 9-1-1
- Emergency Management Agency
- RI Association of Police Chiefs
- RI Association of Fire Chiefs
- RI Hospital Association
- RI Army National Guard

Governing Authority

The Rhode Island Communications Working Group [CWG] is comprised of various communications officials representing several state and local law enforcement, Fire, EMS and Health agencies. The CWG is a sub-committee of the Domestic Preparedness Sub-Committee that reports to the State Advisory Committee for Emergency Management.

3.0 CURRENT ENVIRONMENT

DESCRIPTION OF KEY RADIO COMMUNICATION NETWORKS

RCC conducted a cursory review of several public safety radio communication systems in Rhode Island. The survey was based upon interviews with various representatives of participating agencies. The result is not an exhaustive study of existing radio system, spectrum, and equipment inventory, but an overview of current communication capabilities.

Interviews identified that radio system within Rhode Island are diverse. While some have state-of-the-art digital modulation radio communication systems, others have radio equipment that is 20-years old or more. Subscriber equipment [mobiles, portables, and pagers] varies in manufacture and in age. Overall, equipment reliability was rated very good, with the majority of the departments indicating that their units receive periodic maintenance.

RI State Police [RISP]

The RISP radio network is a conventional radio network comprised of several VHF Highband [155 MHz] channels located at various radio sites statewide. The six [6] RISP Barracks have communication consoles operating these hilltop base stations. All sites are interconnected using the State Police microwave radio network. The following table identifies these systems:

SYSTEM	RADIO SITE	COMMENT
RISPERN[2]	CHOPMIST & EXETER	USED TO COMMUNICATE WITH LOCAL LAW ENFORCEMENT DEPARTMENTS. PRIMARILY USED BY SOUTHERN RI DEPARTMENTS, WHILE THE POLICE INTERCITY CHANNEL IS USED MORE BY NORTHERN DEPARTMENTS
NORTH ZONE REPEATER	CHOPMIST	HAS BACKUP STATIONS AT CHEPACHET, LINCOLN, AND N. SCITUATE BARRACKS CHANNEL EXPERIENCES SEVERE CO-CHANNEL INTERFERENCE FROM NHSP
SOUTH ZONE REPEATER	EXETER	HAS BACKUP STATIONS AT PORTSMOUTH, HOPE VALLEY, AND WICKFORD BARRACKS
STATEWIDE REPEATER	EXETER	
INFO CHANNEL	CHOPMIST & EXETER	USED FOR FIELD INQUIRIES OF STOLEN VEHICLES AND PROPERTIES, WANTED PERSONS AND VEHICLE REGISTRATION INFORMATION

[2] RISPERN – Rhode Island State Police Emergency Response Network

SYSTEM	RADIO SITE	COMMENT
DETECTIVE CHANNEL	CHOPMIST & EXETER	
SWAT	NO BACKBONE NETWORK	

The microwave network is a 6GHz DS-3 digital network comprised of 11-hops. It is configured in a ring arrangement, and provides reliable point-to-point communications interconnecting key radio sites and state buildings. The network's primary function is for support of land-mobile radio for multiple state agencies. The system has capacity for 672 voice and low speed data circuits or up to 27 DS-1 circuits. The network currently transports RISP, DEM, and RIPTA radio and data circuits.

Both of the land-mobile and microwave radio systems were upgraded in 1996\1997 due to FCC mandated clearing of the 2 GHz band for PCS operations. Many of the transmitter sites were upgraded with new shelters and towers during this time. SPRINT Communications financed the system upgrade as part of their commitment of being a PCS spectrum auction winner.

The state police also operate a mobile data communications system. The network provides a means of field inquiries of stolen vehicles and properties, wanted persons and vehicle registration information. Text messaging is also utilized by dispatchers and field officers.

The current wireless data network, which is also shared by all Rhode Island Cities and Towns, utilize Panasonic laptop computers and CDPD[3] RF modems operating at 19.2 kbps. CDPD is a statewide commercial data network provided by Verizon. Verizon has announced that it will discontinue CDPD service by December 2005.

This system is an important augmentation to the RISP RILETS[4], which is a wired statewide Frame Relay [56kbps/T1] data network provided by Verizon. This leased backbone provides all RI Law Enforcement entities with RILETS [NCIC[5], NLETS[6], CAD[7], RMS[8], etc.] application at the desktop, and at the wireless data terminals in vehicles. It is the intent to expand this network to other state agencies allowing mobile data operation for field personnel.

[3] CDPD - Cellular Digital Packet Data

[4] RILETS – Rhode Island Law Enforcement Telecommunications System

[5] NCIC – National Crime Information Center

[6] NLETS – National Law Enforcement Telecommunications System

[7] CAD – Computer Aided Dispatch

[8] RMS – Record Management System

Department of Corrections [DOC]

The RI DOC currently operates an LTR based, single site, 10-channel, 800 MHz trunked radio system manufactured by Uniden. The system is approximately 15-years old and is located at the DOC campus in Cranston. For off campus communications, there are two 800MHz conventional repeaters located in Cranston and Exeter. These are referred to the North and South repeaters.

The trunked system provides reliable coverage on-campus and inside buildings. The off campus repeaters provide some level of coverage, but it is not statewide. Nextel radio units are used where trunked coverage is lacking. Poor/no signal areas include NW portion of RI [Pascoag, Burrillville area], parts of Woonsocket and downtown Providence.

Department of Transportation [DOT]

RI DOT has a two [2] site Motorola Smartnet, 800MHz simulcast trunked radio system located at the Exeter and Johnston radio sites. The sites are linked to Capital Hill via leased T1 circuits from Verizon. There are also two [2] fill-in repeater sites located at Block Island and at Cumberland. These are stand-alone repeaters. The network was constructed in 1987, but was upgraded in 2002. Frequencies are in the 806MHz band. Dispatch uses Motorola Centracom-II console for radio control.

The system was designed for 90% - 90% statewide mobile radio coverage [not for hand-held portables]. There are coverage problems in the NW portion of RI and in many low-lying areas throughout the state.

Department of Environmental Management [DEM]

The RI Dept of Environmental Management conducts its radio communications in the VHF frequency band. It utilizes two [2] transmitter tower sites located at Chopmist and Dolly Park for statewide communications. The stations are configured with receiver voting and transmitter steering. Other receiver voting-only sites are located in South Kingston, Lincoln, and 83 Park St in Providence. All sites are interconnected using the RISP 6GHz microwave system. Control of the network is by a Motorola Centracom-II Communications Console located at 83 Park Street. DEM also operates a VHF Low-Band radio system for non-law enforcement DEM Agencies. Nextel radios are used for secure communications between staff and supervisors. There are also three [3] stand-alone base stations located at State Parks for local coverage.

The Department estimates that their system provides 90% mobile coverage, and approximately 85% hand-held portable communications statewide. However, hand-held portable coverage improvement is required statewide due to officers working alone in remote areas – this is considered a critical issue.

Department of Health [DOH]

The RI Department of Health currently does not have a radio system but leases communications from Nextel for its day-to-day and emergency communications needs. The Health Department has recently initiated the Interagency Nextel Hospital Communications Network [INHCN] to establish 2-way radio communications between hospitals, regional dispatch centers, and other State agencies.

The INHCN radios are installed in the hospital's Emergency Department and are used for day-to-day communications for administrators, the distribution of diversion information to hospitals and dispatch centers, and for coordination of activity in a mass casualty event.

Communications between hospitals and EMS personnel/ambulances are currently conducted using commercial cellular telephone. EMS CMED[9] and HEAR[10] radio systems were abandoned several years ago.

Users indicate that Nextel coverage is not universal and that there are significant dead spot areas statewide, especially inside buildings. Nextel coverage maps for RI shows almost statewide coverage, with the exception of locations on the western border and the northeast.

DOH is currently re-instituting the HEAR network statewide to provide increased reliability and signal coverage needed for critical ambulance to hospital communications. The HEAR system is a dedicated VHF Highband communications network for the EMS community.

Emergency Management Agency [EMA]

The RI EMA currently operates and manages several radio communications networks that are shared with many Federal, State, and Local government Department\Agencies. These radio networks are operated and managed from the State EOC.

In Rhode Island, the primary EMA statewide radio network, CDSTARS[11], is used to communicate with 60 Federal, State and Local public safety and volunteer organizations. This is a VHF Highband radio network that is configured in a point-to-multipoint arrangement where all remote locations, typically local EMA offices, are equipped with CDSTARS radios to communicate directly with EMA at the State's EOC. There is limited agency-to-agency communications on this network.

EMA also has a VHF administrative radio system used for internal statewide communications.

[9] CMED – Coordinated Medical Emergency Direction

[10] HEAR – Hospital Emergency Administrative Radio

[11] CDSTARS – Civil Defense State Radio System

RI Law Enforcement

There are various Police Department radio systems located throughout RI. Some of the frequencies are shared between multiple departments due to lack of available frequencies. Approximately 75% of the departments utilize VHF frequencies, and approximately 25% are using UHF frequencies. The larger city departments typically use UHF channels. There is a statewide police intercity radio frequency that is typically overloaded.

Several single site radio systems support law enforcement communications throughout the state. Typically, due to constraints by limited budgets, law enforcement relies on less functional communications systems.

Signal coverage varies across the state with some departments having reliable coverage, but most could use coverage improvements.

RI Fire Departments and EMS

There are various Fire Department radio systems in RI. Many of the frequencies are shared between multiple departments due to lack of available frequencies. Approximately 75% of the departments utilize VHF, and approximately 25% using UHF frequencies. There are a couple of departments still using VHF low-band channels [30 – 50 MHz]. There is a statewide fire intercity radio frequency that is typically overloaded. About 75% of the fire departments provide EMS services, with Fire apparatus typically dispatched with rescue units/ambulances on emergency calls.

Several single site radio systems support fire and EMS communications throughout the state. Typically, due to constraints by limited budgets, fire departments rely on less functional communications systems.

As with law enforcement, signal coverage varies across the state with some departments having reliable coverage, but most could use coverage improvements.

State of Rhode Island 9-1-1

The State of Rhode Island's 9-1-1 Center is comprised of a single PSAP[12] located in North Providence. The Center answers emergency telephone calls from citizens statewide. Calls are then transferred to one of 67 secondary PSAP Centers that are located throughout State. Transferred calls utilize leased lines from Verizon. The secondary PSAP Centers dispatch the appropriate responding emergency personnel on various radio systems.

There is no radio system associated with 9-1-1. However, the 9-1-1 Center does have control stations to communicate on both the Police and Fire Intercity radio channels. These are used as backup communications should inter-PSAP wire lines fail.

[12] PSAP – Public Safety Answering Point

9-1-1 also has CDSTARS and RITERN radios to communicate with EMA and dispatch points respectively in emergencies.

RI Army National Guard

The RI Army National Guard operates two radio systems that have statewide coverage. One system is comprised of a single VHF highband repeater located at a site in Cumberland. The other network is a two site VHF lowband repeater system located at sites in Cumberland and Smithfield.
The current system employed by the RI NG provides the required reliable communications.

Rhode Island Public Transit Authority [RIPTA]

RIPTA is currently constructing a 7-site, 4-channel Motorola 800 MHz trunked simulcast radio network for their buses. Of the three RI trunked systems, this network will provide the best overall statewide mobile coverage due to the number of radio sites. Signal coverage was designed for 90% mobile.

RIPTA would be a participant in a large-scale unusual event requiring transportation or evacuation of personnel, and requires reliable internal communications for coordination of activity. They also would require communications with EMA, which would be conducted on the RITERN network

Subscriber Equipment Inventory

The following table is an estimate of subscriber equipment inventory [mobile, portables, pagers] currently in use by the departments. It also identifies Nextel radios used by state and local entities. Certain assumptions were used to identify current inventory for the 39 local police departments and 70 fire departments. A physical inventory is required to determine correct amounts.

DEPARTMENT	MOBILE RADIO	PORTABLE RADIO	NEXTEL RADIO
**RISP	220	220	UNKNOWN
HOSP	0	0	DEE DOH
EMA	10	30	59
DOC	87	781	37
DOH	0	0	116
**DEM	100	60	61
E 9-1-1	0	0	UNKNOWN

DEPARTMENT	MOBILE RADIO	PORTABLE RADIO	NEXTEL RADIO
**DOT	380	25	187
NAT'L GUARD	40	0	UNKNOWN
**RIPTA	310	30	673
39 P.D. DEPTS.	467	2,349	1,000 APPROX.
70 F.D. DEPTS.	1,319	2,242	[SEE P.D.]
TOTAL	2,933	4,388	2,133

***Designates Core State Agencies*

-Summary-
Projected Number of Subscriber Units

	ESTIMATED SUBSCRIBER TOTALS
CORE STATE AGENCIES	**1,345**
OTHER STATE & LOCAL DEPARTMENT\AGENCIES	**5,976**
SYSTEM TOTAL	**7,321**

Sources

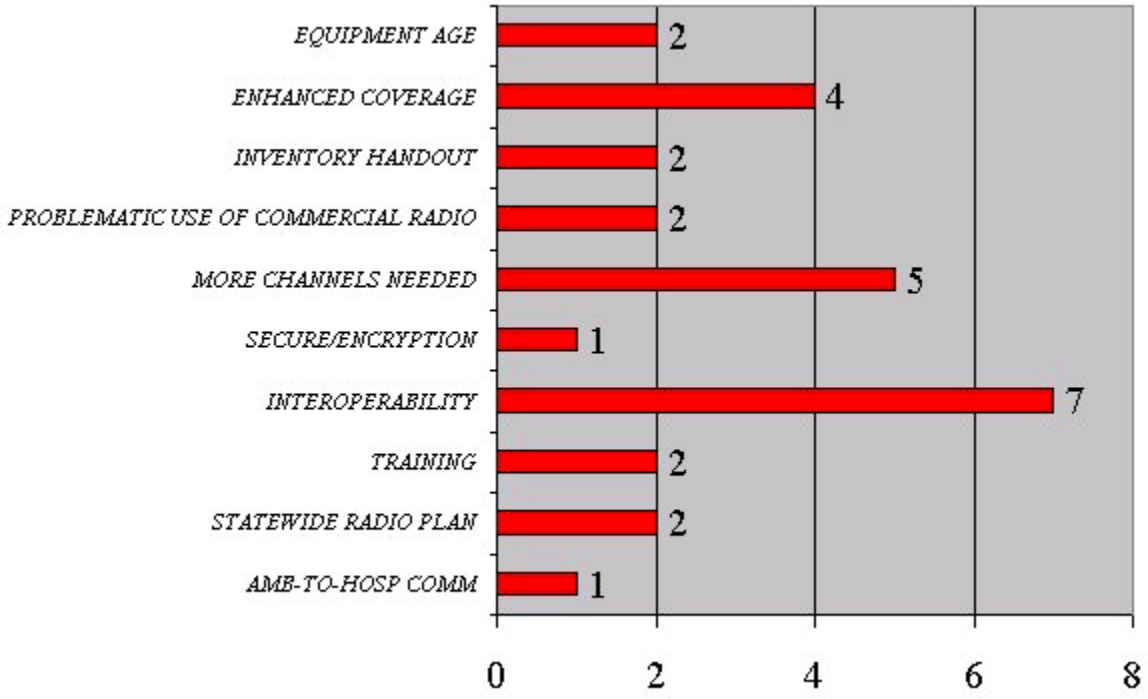
1. Law enforcement sworn officer and vehicle data obtained from the RI State Municipal Law Enforcement Survey, Computerization Report of October 2002.
2. Fire district personnel and vehicle data obtained from the RI Chiefs Association, Mutual Aid Plan FY 2002
3. NEXTEL units estimates provided by NEXTEL

4.0 FINDINGS

EXISTING SYSTEM PROBLEMS

As previously mentioned, RCC obtained information by conducting personnel interviews or from the results of questionnaires filled out by personnel who use the system[s] on a day-to-day basis. Although the current networks has evolved over a number of years, and generally served the agencies well, RCC did identify some problems areas that should be resolved. The following table summarizes some of the deficiencies.

Table Shows the Number of Agencies Reporting Problem Areas



All interviewees in Rhode Island were asked what they considered their three [3] major radio related problems. The results are as follows:

The results infer that the current public safety radio system in Rhode Island exhibit at least three [3] major concerns. They are:

[1] Interoperability with other departments or jurisdictions

[2] Insufficient operating channels

[3] Enhanced coverage, especially for hand-held portable radios

COMMUNICATIONS INTEROPERABILITY

Interoperability refers to the ability of any user group to coordinate and communicate directly with one or more other user groups. Lack of interoperability is identified as a major problem in Rhode Island. The ability of public safety organizations to communicate under normal, or emergency circumstances, is fundamental to the safety of the public and to those who serve them. Radio communications is a crucial ingredient in responding and coordinating activity at an emergency event.

Lack of Interoperability - In today's homeland security environment, there is a significant need for alert notification in the event of a disaster or multiple casualty events. In Rhode Island, there is no statewide or regional communications network that allows effective real-time voice or data communications between all Law Enforcement, Fire, EMS, hospitals, or other state organizations\agencies.

The increasing complexity of unusual events and manmade/natural disasters are changing the requirements for a coordinated multi-agency response among different levels of government, whether Local, State or Federal. Independent and incompatible radio systems have created a technological environment that is difficult, and at times impossible, for agencies to effectively communicate with one another. This problem exists in Rhode Island.

Many public-safety responders, who typically multi-task when coordinating personnel and equipment at unusual events, or mass casualty incidents, face several challenges. One of the challenges is having effective radio communications. As more and more departments arrive to the scene, communication problems are compounded.

Responders arrive on the scene with their day-to-day radio system. Many times this radio is not compatible with another agency radio they need to communicate with. The problem is generally solved, but at the expense of diverting personnel resources or distracting others to establish the much needed communications. This scenario has been played out several times over nationwide. Here are some examples:

- Oklahoma City Bombing: Police and Fire radio channels quickly became congested and overloaded. In a short time the cellular system too was overloaded

- Columbine: Radio channels quickly were jammed and the Dispatch Center loss communication with the Command Post – all within the first hour. All public safety and commercial radio communications were overloaded.

- Similar problems were encountered at the 1993 World Trade Center, the Waco Texas standoff, and many other locations nationwide not documented but certainly experienced too often by public safety personnel.

- Rhode Island has not escaped the communications interoperability problem, recent experience at the Station fire in West Warwick identified communication problems.

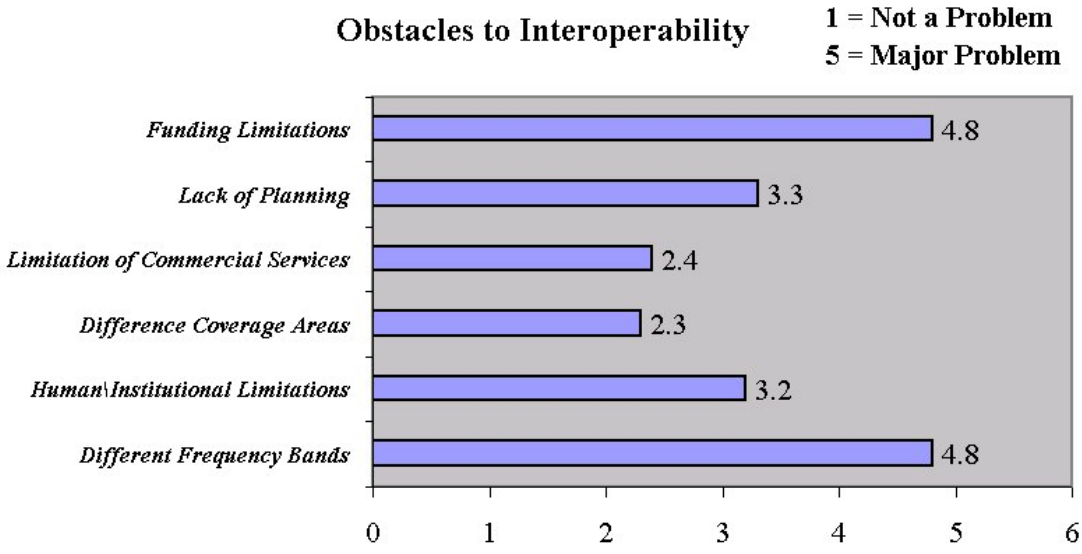
Effective interoperability requires that Incident Commanders have direct radio communications with on-scene public safety personnel for coordination of personnel and equipment. In a multi-jurisdiction response using radios on differing frequency bands, on-scene communications cannot be accomplished.

Additional challenges arise for mutual aid between police and fire services, public works, or other agency within the public-safety discipline that operate on different frequency bands. In these instances, dispatcher intervention is utilized to relay messages between the two organizations with dissimilar frequency bands. This may introduce errors or misinterpretation of message because the dispatcher will be busy coordinating other functions during emergencies.

Law Enforcement: In Rhode Island, law enforcement communications are conducted on VHF Highband [155MHz] and UHF [450MHz]. Most departments utilize VHF frequencies; however, the larger cities such as Providence use UHF, thus creating a communication gap. For an example, State Troopers cannot use the radios in their vehicles to communicate with a Providence police vehicle and must rely on their dispatcher for verbal relay.

Fire and EMS Services: In similar fashion, approximately 75% of the fire departments utilize VHF and approximately 25% are using UHF frequencies. There are a couple of departments still using VHF low-band channels [30 – 50 MHz]. This is an obstacle to some departments in conducting mutual aid communications. If sharing the same frequency band, there exist some inherent level of interoperability among fire personnel from the use of fireground channels.

To be effective, interoperability must provide direct communications among personnel at the scene. Coordination of activities involving departments or other jurisdictions operating on different frequency bands cannot be readily accomplished in the field.



INSUFFICIENT OPERATING CHANNELS

Unfortunately, Rhode Island public safety and public service agencies currently operate in every frequency band allocated by the FCC. This includes VHF low and high-bands, UHF, and 800 MHz frequencies. Many of the agencies are currently operating near, and in some cases exceeding, the capacity of their existing communications systems. Radio spectrum allocated for public safety has been fully assigned in most urban areas of Rhode Island; simply, there are no or little additional channels available.

Nearly all police and fire interviewed cited channel congestion on the InterCity Police and InterCity Fire radio channels as a major problem. Under current conditions, only one channel is available statewide for each of the services to coordinate emergency response activity. During periods of peak activity and especially during incidents requiring the coordination of multiple jurisdictions, a single channel cannot adequately support the interoperability requirements of both public safety services. In addition to being a potential communications bottleneck, the use of a single channel for coordinating activity involving several departments will render the channel unavailable for long periods. This causes confusion among the agencies that results in lost or delayed messages, or getting them confused with those intended for another department. Existing dispatch channels need to be clear and as a result, cannot be relied on for mutual aid operations.

Because of lack of operating spectrum, and in some cases poor signal coverage, many state agencies have turned increasingly to private communication providers, such as Nextel for two-way radio and cellular telephone usage. These services alone, however, are insufficient to fully address Rhode Island communication problems.

INADEQUATE COVERAGE

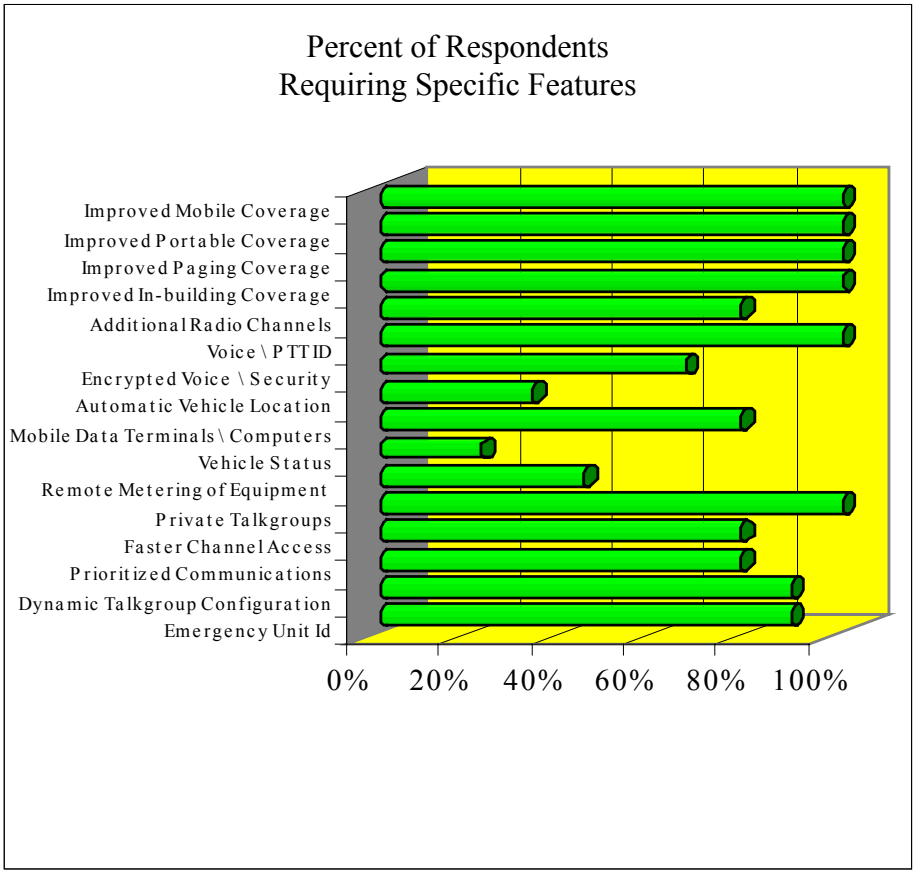
Radio coverage is identified as a problem in many areas of the state, especially for hand-held portables. This problem varies system by system because some departments coverage design requirements is for mobile radio only coverage, while others is for hand-held portable radio coverage. In addition, propagation reliability specification may differ, some agencies require 90% coverage availability, while others require 95% availability. Many users indicated that coverage is poor in the northwest and southwest regions of the state where the terrain is hilly. Other radio users have also expressed problems with in-building portable coverage. In-building portable coverage concerns are predominantly experienced by radio users operating in urban areas and is typically considered a critical problem, especially for the fire services.

It is important to clarify the meaning of coverage area availability. This number is a statistical result based on the reliability of the signal level predicted by computer models that could be field verified by measurement. That is, it is a measure of signal propagation reliability. For 95% reliability, it indicates that a portable or mobile radio will receive a signal that is above a specified design level 95% of the time at 95% of locations.

It is impossible to actually obtain 100% area availability just as it is impossible to test every square centimeter of the service area to verify coverage. Field verification is accomplished by dividing the coverage area into grids, and testing each grid for minimum acceptable communications. For example, if 1,000 grids were tested, then 95% of the grids [950 grids] have to have acceptable communications to pass.

SYSTEM REQUIREMENTS

Respondents to the questionnaire were asked to evaluate and identify functions and features they may require in an upgraded system. The chart below summarizes key features of a technology-based radio system.



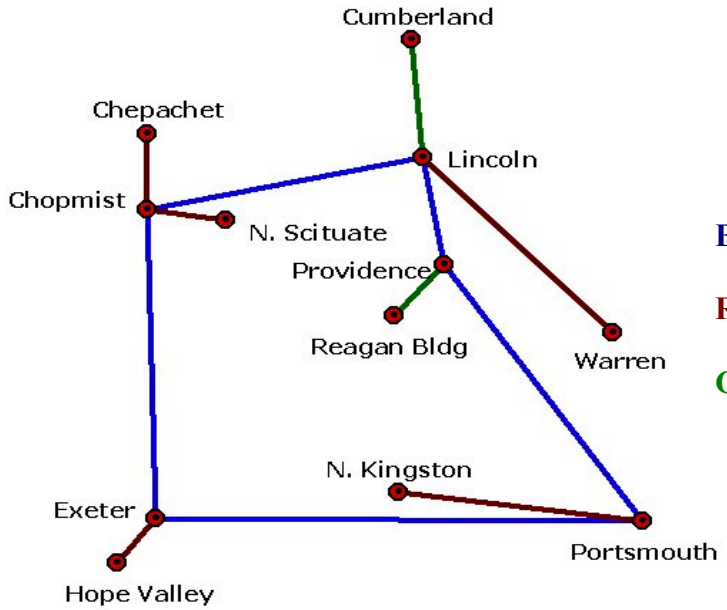
DUPLICATION OF TECHNOLOGY-BASED WIDE AREA COMMUNICATION SYSTEMS

There are three [3] major regional 800 MHz trunking systems in Rhode Island that support major State agencies. These are RIDOT, RIPTA, and RIDOC. These systems provide redundant overlapping coverage throughout the state. The two major systems, RIDOT and RIPTA, have trunked systems provided by Motorola that are compatible. The RIDOC trunked system, provided by Uniden, employs a different communications architecture that is not compatible with Motorola trunked systems. These two system manufacturers support disparate technologies that prohibit direct communications between each system. The RIPTA system has been constructed but not placed into service as of the date of this report. Statewide coverage testing is currently being conducted.

MICROWAVE RADIO NETWORK

The State Police microwave network is the predominant wireless backbone supporting State land-mobile radio infrastructure. It is a 6GHz DS-3 digital network comprised of 11-hops. It is configured in a ring arrangement and provides reliable point-to-point communications interconnecting key radio sites and state buildings. The network's primary function is for support of land-mobile radio for multiple state agencies. The ring has capacity for 672 voice and low speed data circuits or up to 27 DS-1 circuits, while the spur hops are 12 DS-1 circuits. There are two 960MHz microwave links providing fractional DS-1 service to two sites. The network currently transports RISP, DEM, and RIPTA radio and data circuits.

State of Rhode Island
6GHz Digital Microwave Network



Blue = 27 DS-1 Ring

Red = 12 DS-1 Spurs

Green = Fractional DS-1 Spurs

COMMUNICATIONS SITE RESOURCES

Rhode Island has valuable communication site resources that serve many of the State's radio systems. These sites have been upgraded in recent years. Some towers are new, others have been modified. Many sites have new communication shelters and all are equipped with uninterruptible power supplies [UPS] and emergency power generators.

These sites represent an enormous investment by the State in land and infrastructure, and many sites could be used for build-out of a new system or leased to commercial providers of communication services.

MOBILE DATA COMMUNICATIONS

The current wireless data network, which is also shared by all Rhode Island Cities and Towns, utilize Panasonic laptop computers and CDPD[13] RF modems operating at 19.2 kbps. CDPD is a statewide commercial data network provided by Verizon. Verizon has announced that it will discontinue CDPD service in December 2005.

This system is an important augmentation to the RISP RILETS[14], which is a wired statewide Frame Relay [56kbps/T1] data network provided by Verizon. This leased backbone provides all RI Law Enforcement entities with RILETS [NCIC[15], NLETS[16], CAD[17], RMS[18], etc.] application at the desktop and at the wireless data terminals in vehicles. It is the intent to expand this network to other state agencies requirement mobile data for field personnel.

Law enforcement agencies are the predominant users of mobile data applications and utilize it for various purposes including RILETS inquires, electronic messaging, status messaging and broadcast announcements. More than 500 public safety agencies in Rhode Island utilize mobile data to support their operations. While law enforcement is the predominant user of mobile data communications, a majority of non-public safety agencies in Rhode Island does not have mobile data capabilities. However, fire and EMS officials indicate that they will be implementing mobile data communications network in the future.

[13] CDPD - Cellular Digital Packet Data

[14] RILETS – Rhode Island Law Enforcement Telecommunications System

[15] NCIC – National Crime Information Center

[16] NLETS – National Law Enforcement Telecommunications System

[17] CAD – Computer Aided Dispatch

[18] RMS – Record Management System

RITERN[19]

RITERN is a wide-area interoperability project that is currently underway in the State. This strategic radio net, initiated by the Communications Working Group, will provide a level of voice interoperability that is currently lacking in Rhode Island. It provides a direct communication for 78 state agencies. Locations include all communication dispatch centers, E 9-1-1 Center, law enforcement, fire and EMS departments, hospitals, EMA, DOT, and other state agencies.

The network utilizes a talkgroup on the DOT 800 MHz trunked radio system. It allows any agency to communicate with another agency or all agencies. Although RITERN provides a very important communications function, its usage is limited to emergency only transmissions because of traffic loading issues on the DOT trunked network.

The RITERN network should be the model to expand radio communications statewide.

LEASED WIRELESS COMMUNICATION SERVICES - NEXTEL

Many public safety agencies utilize lease communications services, these are typically alert paging and cellular telephone, as well as Nextel. Nextel is currently the only cellular provider that provides push-to-talk [PTT] services [soon be provided by other cell phone companies]. That is, the network not only provides cellular telephone service, but can provide 'walkie-talkie" type communications. This service is attractive to public safety because PTT functionality is identical to public safety radio networks that they are use to. Talk groups can be formed allowing one-to-many communications [as opposed to one-to-one that cellular phone provides].

Nextel has recently become a popular trend among public safety agencies, and is used considerably by many Rhode Island agencies. State and local agencies or departments use Nextel to augment their existing communication systems. These units allow another means of interoperability among the various agencies. At times, the cellular network is used to reach agencies outside a department's two-way radio coverage area.

Currently, Nextel reports that there are approximately 2,100 users statewide. Local cities and towns use approximately half of these.

As described elsewhere in this report, the hospital community has developed a wide area communications network utilizing Nextel services for their day-to-day communications needs, and for mass causality incidents. RIPTA, due to communications problems with their old network, currently utilizes Nextel units for communications with buses. These units will be relinquished when their 800 MHz trunked radio network is completed by the end of 2003.

For law enforcement, commercial wireless telephone function is used for on-scene investigations to communicate sensitive information to other public safety personnel or to private citizens. Cellular telephone is also used when lengthy communications are required.

[19] RITERN – Rhode Island Telecommunications Emergency Radio Network

RI EMS personnel currently utilize cellular telephones to communicate with hospital emergency rooms. This form of communications is not reliable for public safety. EMT personnel have to dial the hospital, wait for a call connection, and then may encounter busies – delaying critical communications while transporting patients. It is common that cellular calls are dropped or interrupted. The health department is currently rectifying this situation by re-activating the HEAR network [Hospital Emergency Administrative Radio, using VHF frequencies.

There are several advantages of leased wireless services.

- [1] It eliminates the requirement for building out a proprietary communications infrastructure;
- [2] It eliminates the initial capital investment required to build a wide area proprietary communications infrastructure;
- [3] It provides communications function without needing to obtain scarce spectrum that is difficult to obtain for wide area systems; and
- [4] Not responsible for maintaining large communications infrastructure.

However, there are also several disadvantages. Perhaps the most significant disadvantage of this service is that during major man-made or natural disasters, particularly in the smaller populated areas where cell sites are equipped with a minimum number of channels, it is likely that the wireless service will encounter busy signals and access to the network may be denied. The traffic handling capacity [loading] of leased wireless services during unusual events, or large incidents, is uncertain since public safety personnel, members of the media, and private citizens are all competing for the same vital airtime.

Priority access, a term used most often by public safety, guarantees that first responders and public safety personnel users have radio communications when they are needed – at all times. Priority access is a major concern for Rhode Island public safety personnel. They want to ensure that they have control during a major crisis so that communications are not disrupted. Public safety communication sites utilize emergency power and typically have reliable microwave links for increased reliability and survivability. Most commercial networks are not equipped with emergency power at remote radio sites. In addition, radio site linking is typically via leased wireline circuits that are unreliable and are subjected to outages.

In addition, commercial signal coverage reliability is characteristically not as reliable as a public safety network due to differing coverage design criteria – public safety requires stricter parameters, especially inside buildings. A critical example is the Station fire in West Warwick where Nextel coverage in the immediate area was poor or non-existent.

SPECTRUM ISSUES

At present, from an operational standpoint, the State agencies generally make use of several frequency bands for their two-way radio systems. These include:

- Low-Band [30-50 MHz] – Low usage
- VHF [150-174 MHz] – High usage
- UHF Band [450-470 MHz] – High usage
- 800 MHz [Conventional and Trunked] – High usage

Note: Rhode Island currently holds a license for 700 MHz frequencies. The FCC mandated New England coordinating committee is currently establishing frequency assignments and technical requirements.

AGENCY	PRIMARY FREQUENCY BAND	STATEWIDE FREQUENCY ASSIGNMENT
RISP	VHF	YES
DEM	VHF & LOWBAND	YES
DOC	800 MHz	NO
EMA	VHF	YES
DOT	800 MHz	YES
DOH	800 MHz LEASED SERVICES	YES
RIPTA	800 MHz	YES
POLICE 39 CITIES & TOWNS	VHF & UHF	NO
FIRE / EMS 39 CITIES & TOWNS	VHF & UHF	NO

Radio spectrum is a very limited resource that is very difficult to obtain, especially for wide area networks. The recent 15 to 20 years advanced-technology improvements have also surfaced that allow more efficient use of radio channels. For commercial users, cellular radio technology has emerged, but for public safety, trunked radio is the advance-technology of choice. Both utilize the 800 MHz frequency band. For public safety, the FCC mandates trunked radio if a licensee is authorized five or more 800 MHz frequencies and protects the frequencies from co-channel interference, establishing exclusive use the licensee's coverage service area. This is not true for frequencies below 800 MHz.

From a system configuration perspective, radio channel trunking allows for the processing of more radio traffic than the older, conventional types of radio systems [frequencies below 800 MHz] currently used by most State agencies. Going forward, more esoteric technical advancements are currently being developed that will allow multiple conversations in radio bandwidth that once carried only a single voice conversation.

Previously mentioned in this report are the trunked systems operated by RIDOT, RIDOC, and RIPTA. RIDOT and RIPTA have multiple statewide 800 MHz frequency authorizations, while RIDOC has authorizations to cover their facilities in Cranston. Authorizations are as follows:

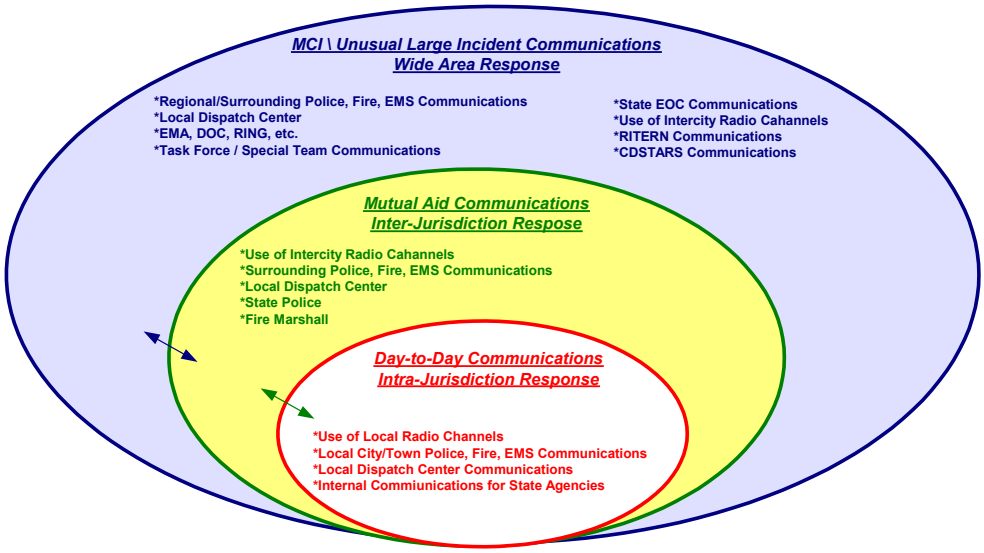
AGENCY	CALL SIGN	COMMENTS
RIDOT	WNQY-360 WNCX-326	6 FREQUENCY PAIRS [806MHZ BAND] 5 LICENSED AT JOHNSTON & EXETER – *AUTHORIZED FOR STATEWIDE OPERATION* 1 LICENSED AT BLOCK ISLAND & CUMBERLAND – *AUTHORIZED FOR 75-MILE RADIUS OPERATION*
RIPTA	WPXB-725	15 FREQUENCY PAIRS [821MHZ BAND] 15 FREQUENCY PAIRS LICENSED AT PROVIDENCE, CUMBERLAND, S. KINGSTON, EXETER, SCITUATE, PORTSMOUTH, CRANSTON – *AUTHORIZED FOR STATEWIDE OPERATION*
RIDOC	WPHX-771 WPQI-443 WPOY-544	13 FREQUENCY PAIRS [806 & 821 BANDS] 10 LICENSED AT CRANSTON [821] – *AUTHORIZED FOR 8-MILE RADIUS OPERA*TION 2 LICENSED AT CRANSTON [806] - *AUTHORIZED FOR 20-MILE RADIUS OPERATION* 1 LICENSED AT EXETER [806] – *AUTHORIZED FOR 20-MILE RADIUS OPERATION*

5.0 ISSUES AFFECTING STATEWIDE RADIO NETWORK

INTEROPERABILITY DEFINED

The ability of public safety personnel to communicate under normal, or emergency circumstances, is fundamental to the safety of the public and to those who serve them. Radio communications is a crucial ingredient in responding and coordinating activity at an emergency event.

Interoperability, as defined by PSWN[20], is defined as "an essential communications link within a public safety and public service wireless communication systems that permits units from two or more different agencies to interact with one another and to exchange information according to a prescribed method in order to achieve predictable results." PSWAC[21] has identified three [3] types of interoperability. They are: [1] day-to-day; [2] mutual aid; and [3], task force.



Day-to-day communications includes routine communications within a department, or departments in a City/Town and the local dispatch center. On the local level, communications systems are typically mature and interoperability is characteristically not a problem.

Mutual aid provides additional personnel and equipment resources from surrounding jurisdictions per a pre-arranged plan for regional assistance. Mutual aid interoperability can be is accomplished in several ways. In Rhode Island, this is accomplished using the police and fire intercity channels. As previously mentioned, this channel quickly becomes overloaded, communications would be stressed or inaccessible in emergencies. Interoperability at this level needs to be improved.

The third type, task force interoperability, involves communications among Local, State and Federal agencies that represent different governmental layers, such as RI EMA, RI National Guard, FBI, FEMA, etc. Interactions with Federal agencies are uncommon for most local departments and more

[20] Public Safety Wireless Network, sponsored by National Institute of Justice

[21] Public Safety Wireless Advisory Committee

common with State agencies. Communication links between Federal and State agencies are considered mature; however, stronger interoperability links are required between local departments and State Agencies. Until recently, there were little or no communications capabilities at this level. CDSTARS provided the much needed communication links; however, the recent deployment of RITERN has greatly improved this functionality. RITERN is considered a stopgap measure until the State develops a truly statewide network.

USE OF EXISTING TECHNOLOGY TO ACHIEVE INTEROPERABILITY

NPSPAC National Mutual Aid Calling AND Tactical Channels

The national NPSPAC channels are intended to provide interoperability among multiple jurisdictions that utilize 800 MHz. Although Rhode Island has yet to implement these channels, they will be required to do so by February 2007 under FCC Rule 90.629, extended implementation period. The use of these channels can be compared to the existing RISPERN network, but having multiple channel capabilities.

The FCC has established[22] requirements for five [5] nationwide 800 MHz common channels for interagency communications in times of natural or man made disasters, acts of terrorism, bio-terrorism, or unusual events. One of the channels functions as a calling channel [ICALL], while the remaining four are utilized as tactical operating channels [ITAC]. The FCC rules require that the Regional Planning Committees [RPC][23] set requirements for the utilization of these shared common channels. In Region-19, the rules state that each 821 MHz licensee must comply by implementing within its authorized area a repeater\base station network whose coverage is equal to its own system.

The Region-19 RPC has the following policy for common channel usage:

- Intended use for non-routine communications by agencies requiring interoperability for inter-agency activities For each aggregate of 5 channels assigned, the licensee must implement one calling channel and one tactical repeater\base station per the RPC plan [e.g. RIPTA is assigned 15-channels and must provide equipment for three [3] sites.
- Single repeater\base station for calling channel
- Single four-channel repeater\base station for tactical channel
- Repeater operation must be disabled until activated for an appropriate mission
- Calling channel must be monitored at all times

[22] FCC Docket 90.53

[23] The RPC advisors for RI is FCC Region-19

Networked-Based Interoperability

One method of networked-based interoperability includes an 800 MHz trunked system that links multiple trunked systems into one wide-area trunked system. For Motorola Smartnet based trunked radio networks [DOT & RIPTA] this is called Smartzone. This configuration allows for wide-area roaming and multi-agency interoperability among the connected systems, which in turn, allows for operations consolidation among participating agencies. The solution allows the individual trunked systems to maintain separate operations for day-to-day matters while providing the capability for large-scale interoperability when needed.

An alternate method of interoperability is to assign multiple talkgroups in a trunked system where many or all subscriber units are programmed for multiple common talk-channels for wide area interoperability. An example of this configuration is the recently deployed RITERN network.

Although RITERN is a fixed network; that is, a point-to-multipoint communications net, a similar expansion could be deployed for mobile operations. In an emergency event, stored 800 MHz hand-held portables would be retrieved from a nearby cache and then deployed on scene. Caches would be located strategically throughout the state.

IMPORTANCE OF RADIO COVERAGE

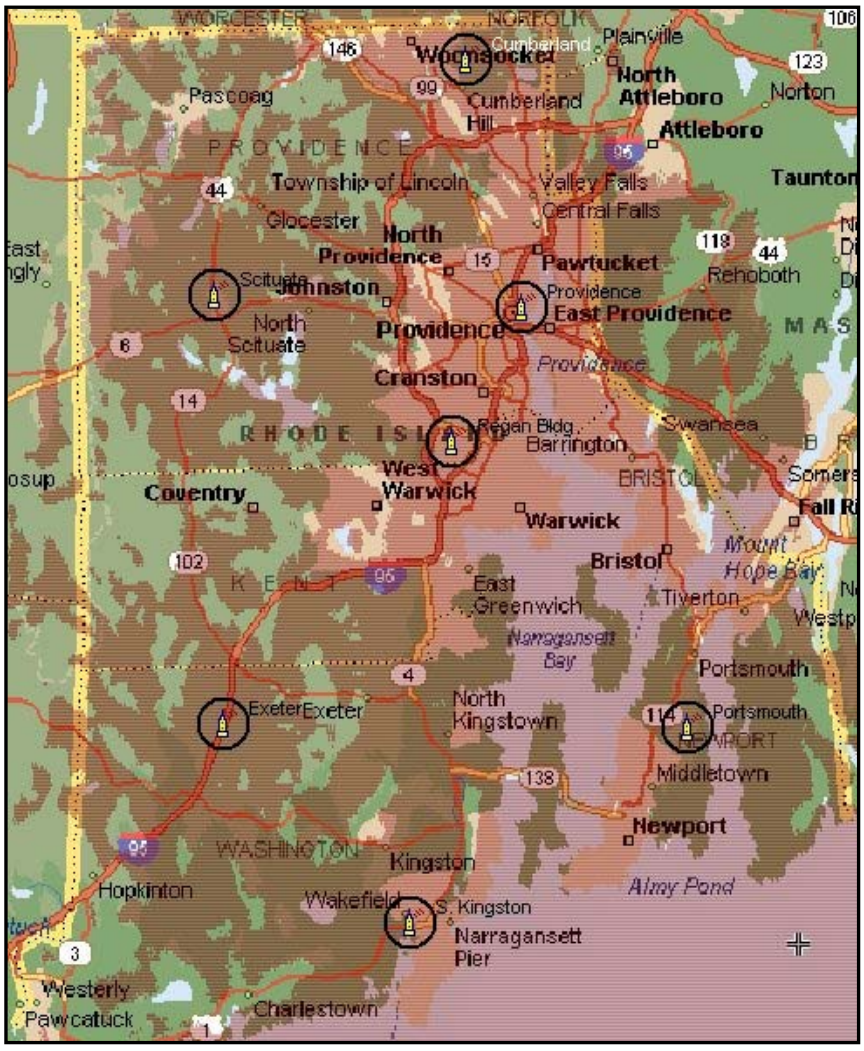
A citizen request for emergency services begins by calling 9-1-1, which is considered the "input" side of the communications center. The equally necessary "output" function of message flow requires a reliable base-mobile radio system. Radio signals transfer information from the fixed communications center location to the appropriate responding personnel in the field. This link, whether by voice or data, provide field personnel delivering emergency services with critical resources at their fingertips. The radio link between the communications center and field personnel needs to be very reliable.

Public safety radio communications needs to continue operating under all circumstances. Communications disruptions interfere and delay the swift delivery of emergency services. Over the past twenty years, radio communication reliability has become a principal consideration for public-safety radio planners. The increased dependence of radio and its extensive use in public safety have created a great demand for greater reliability standards. From its inception during the late 1920's, police and emergency communications generally relied on a single base station site to obtain the necessary communications. Dead spots, and at times skywave interference, were tolerated and accepted as part of communications system. This is no longer true.

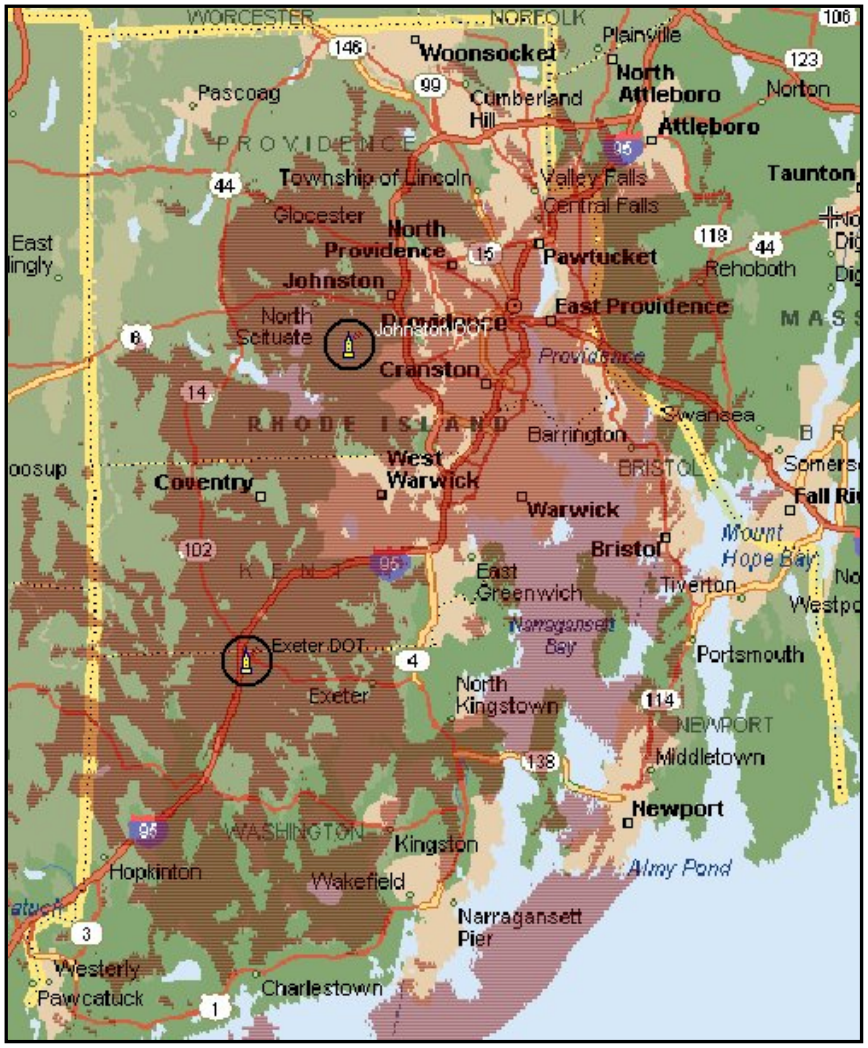
Over the past decade, public-safety radio communications has experienced continuing growth and change. A major trend is movement to enhance communications with vehicles by using mobile data and automatic vehicle location systems. More importantly, migration toward communications with persons with portable hand-held radios and paging receivers has become a strict requirement.

Basic communications capabilities must be available to every public safety provider in the State in order to respond to the public's needs. RCC's recommendation is for minimum 95% hand-held portable radio coverage, with special concern for in-building signal coverage. Coverage specification will be based on TIA/EIA TSB-88 Technical Bulletin. Special considerations will be required for large signal hardened buildings.

It should be recognized that an affordable radio system could not provide 100% coverage. There will always be deep valleys and large buildings where coverage is unavailable. However, every effort must be made to design a system that provides the optimum coverage. Increased coverage reliability will require a design that is somewhat different from the present design.



Existing RIPTA 800 MHz Coverage
7-Site\4-Channels Simulcast System
90% Mobile Reliability



Existing DOT 800 MHz Coverage
2-Site\5-Channels Simulcast System
90% Mobile Reliability

Note: Coverage outside of the red area does not imply no coverage, only that it is less than 90%

SPECTRUM ISSUES

800 MHz Spectrum

In the late 1970s, the FCC released some 3.5 MHz of spectrum in the 806-821\851-866 MHz band, which yielded some 70 channels for public safety/state and local government usage. In some cases, public safety agencies were also able to obtain 800 MHz channels initially set aside for business, commercial and industrial users in order to supplement the 70 channels. One positive attribute of this band is the orderly allocation of channels and specified geographical separation of radio systems. This process allowed the implementation of a technology-based network known as trunking. Trunking is mandated by the FCC for all systems that employ five or more channels. Trunked systems allow for the efficient use of radio spectrum and allow the inclusion of features not normally available in conventional systems.

The 806-860 MHz band is very well suited for use in urban and suburban areas and can be successfully applied in rural areas if the correct system configuration is implemented. Coverage in rural areas with rough terrain and heavily forested areas can require that a relatively large number of sites be implemented in order to receive the desired radio coverage.

Most agencies that have migrated to this band and technology are not likely to relocate to another band, as these systems generally do a good job of meeting the individual needs of the users. The RIDOT trunked radio system is licensed in this band, which commonly known as the 806 Band.

The 806 band was quickly utilized, and in just a few years, frequencies in the major metropolitan areas were all assigned. As a result, public safety users petitioned the FCC to reallocate additional frequencies in the 800 MHz band for public safety use only. In 1986, he FCC concurred and reallocated 230 radio channels in the 821 MHz band for public safety use. These channels are currently licensed by both RIPTA[24] and RIDOC. This new band is commonly referred to an s the 821 Band.

However, prior to reallocating these new channels, the FCC recognized that the new allocation would still fall short of meeting the overall demand for channels in the public safety field. Consequently, the FCC decided to develop new guidelines that would foster a more efficient use of the new frequencies.

The overall goal of the FCC was to limit radio coverage for a system user to its geographical boundaries, rather than allow users to transmit their signals far beyond their actual service area as is frequently done today. By confining a user's signal to the actual geographic service area, frequencies could be re-allocated in closer intervals.

[24] The RIPTA channels were previously licensed to the State Police but were re-assigned to RIPTA for their new system. There is an inter-agency agreement to re-assign the channels back to the State Police should they implement a trunked radio network.

As a result, the FCC established an advisory committee known as the National Public Safety Planning and Advisory Committee [NPSPAC] to determine how such a plan could be implemented regionally on a national basis. The NPSPAC committee determined that one global plan would not meet the needs of the various localities spread across the country. Therefore, the FCC divided the country into several regions, and has allowed each region to develop its own public safety communications plan with specific guidelines and requirements relevant to that particular region.

The State of Rhode Island is in Region-19, the New England region, and has direct representation on the Regional Planning Committee [RPC]. In accordance with Federal guidelines, the Region-19 plan calls for the limitation of geographic radio coverage to a user's service area. The limitation of coverage is achieved by limiting the antenna height and\or transmitter power for systems operating in the 821 MHz band.

This is unlike the 806 band, where system users could have installed the tallest possible tower and operate under the maximum available transmitter power. Public safety users who must cover a large geographic area are forced to look at alternative system designs to provide wide area coverage, since maximum height and power are no longer allowed. Put simply, this means that public safety users who use 821 MHz channels are faced with a higher system design and implementation cost than if the system were implemented using 806 MHz band that do not experience these limitations.

To the extent that channels are available, the 800 MHz band is potentially a good supplement to the newly allocated and emerging 700 MHz band discussed below, given that both employ digital technology. New dual-band radio equipment provided by the various manufacturers can operate in both the 700 and 800 MHz bands, which is a significant advantage. In the Rhode Island area, the RITERN network already utilizes radio equipment that can be programmed in 700\800 MHz bands.

ReBanding - Proposed 806 MHz and 821 MHz Band Changes

The use of the 806 MHz band has broadened over the years, and new technologies have been introduced. Nextel Communications Inc. is one of the commercial operators that have implemented a cellular\dispatch type [push-to-talk] system using radio channels that, in many cases, are adjacent to and\or interleaved with the 806 MHz public safety/local government channels. Nextel's radio channels were obtained in spectrum auctions held by the FCC and a technology commonly known as iDEN has been employed. Due to the method in which the radio channels have been allocated, and due in part to the manner in which the systems are designed and deployed, interference to public safety trunked systems in the 806 MHz band has increased, and is a problem in many systems. Nextel is a major operator in the 806 MHz band.

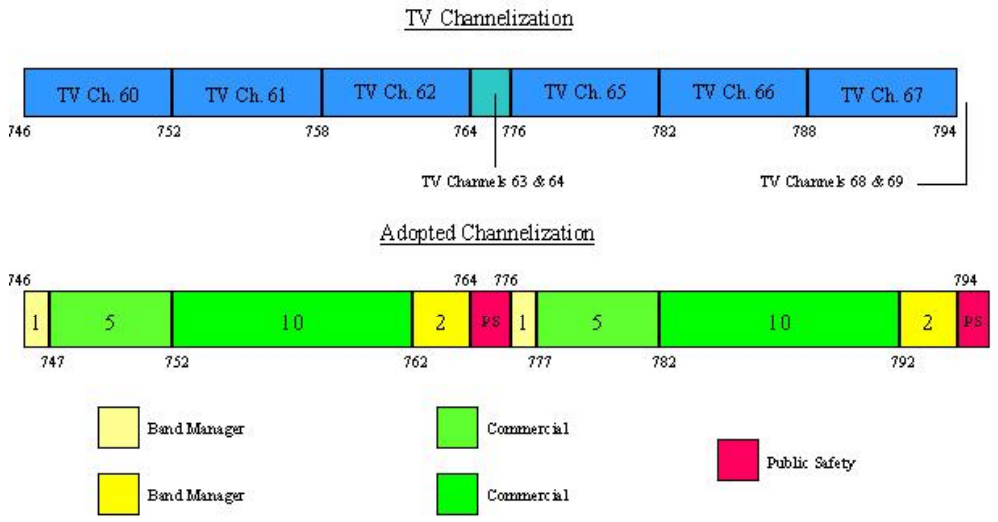
In 2002, the FCC has stated that this harmful interference must be remedied. Nextel had made an earlier proposal to the FCC in November of 2001 outlining what it believed were the steps that should be taken to reduce the interference. Nextel's plan called for the clearing the 806 MHz band of all commercial services, and the relocation of all public safety users that are licensed in the 821 MHz band to the 806 MHz band. For Rhode Island, both the RIPTA and DOC systems would be affected.

Nextel has indicated that they would fund the relocation effort in an amount not to exceed $850 million, provided that FCC grants Nextel 10 MHz nationwide frequencies in the 1910-1915/1990-1995 MHz frequency band. This will be in exchange for Nextel to surrender more than 10 MHz of its licenses at 700 MHz, 806 MHz and 900 MHz. However, earlier estimations by manufacturers and user groups estimate the relocation effort to be in the range of $1 billion to as much as $4 billion. If the FCC agrees with the authorizes rebanding proposal, the State of Rhode Island may be eligible for Nextel funding for rebanding the RIPTA and DOC systems.

At this time, although the FCC has released a docket for proposed rulemaking, the outcome is uncertain, but given the history of the FCC in these matters, any final decision may take several years.

700 MHz Band

The National Telecommunications and Information Administration (NTIA), and the FCC formed the Public Safety Wireless Advisory Committee (PSWAC) to address the radio spectrum requirements of all public safety entities through the year 2010. NTIA is in charge of the management and control of the radio frequency spectrum used by federal government agencies and the military. The FCC and the NTIA have a very close working relation in matters relating to the general allocation of spectrum.

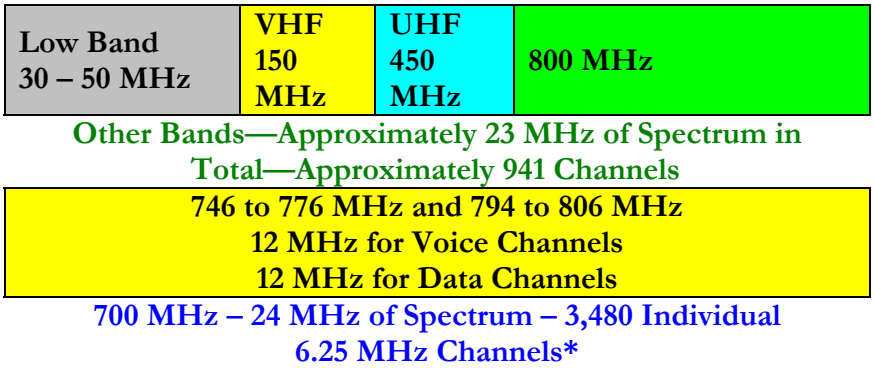


In 1996, PSWAC presented their report to the NTIA and the FCC. One of the most significant recommendations of the report called for the release of portions of the 746 to 806 MHz spectrum presently allocated to UHF-TV Channels 63, 64, 68 and 69. This block of spectrum contains a total of 24-MHz comprised of two paired 12-MHz blocks.

In 1998, the FCC adopted rules for the use of the spectrum recommended by PSWAC. This allocation represents the largest block of spectrum ever allocated at one time for public safety services. Eligible users of this spectrum include state and local government entities; and non-governmental organizations specifically authorized by appropriate state and local agencies. Federal entities will not have use of this spectrum other than the channels to be designated as nationwide interoperability channels.

Most recently, the FCC has reallocated 24 MHz of new radio spectrum in the 700 MHz band for Public Safety applications. This is a significant event in the communications industry because there is more radio spectrum available in the new 700 MHz allocations than in all of the Public Safety allocations in the VHF, UHF, and 800 MHz bands combined.

Figure 1 - Comparison of the Amount of Spectrum at 700 MHz Versus the Other Bands



*** The band plan calls initially for channels that will operate in 12.5 KHz bandwidths with a migration to 6.25 KHz. Channels may be aggregated from 25 KHz to 150 KHz for certain applications. (240 of the channels will be allocated in 50 KHz assignments for data usage).**

In 2000, the FCC also set aside 2.4 MHz (approximately 200 channels) of 700 MHz spectrum specifically for states to use to develop new statewide radio systems. Rhode Island currently holds a license for these statewide channels.

Additionally, there are also hundreds of channels available for cities and counties to use to replace their outdated systems or to join the State in the development of this system. The new FCC rules regulating the use and operation of the 700 MHz channels have been designed in a manner that will help eliminate many of the operational problems that currently occur in the lower frequency bands.

Specific spectrum was set aside for use by the states to develop new statewide radio systems. This state reserved spectrum consists of 192 channels at 6.25 kHz spacing, which are removed from the allotment authority of the Regional Planning Committees. Rhode Island has taken the necessary steps to reserve this spectrum and the State has received an FCC license for this spectrum. The block license will permit the operation of any channel at any location in the State without further specific licensing. This licensing flexibility is unique in the public safety band. State use of these channels must wait until radio standards are established, equipment is type accepted, and TV broadcast issues are resolved.

Clearing The 700 MHz Band For Public Safety

The 700 MHz radio spectrum is currently in use by the television broadcasters in the United States. Each television station has been allocated a new high-definition television [HDTV] channel for use by the station to transition its broadcast operations from the current analog format, which has been in operation for over 60 years, to the new digital high-definition television format with a transition date of January 1, 2006.

However, a TV station will be permitted to continue analog broadcasting beyond 2006 [and to retain the extra channel it received from the FCC for the transition] if less than 85% of the households in its market have at least one of the following:

- digital TV delivered by cable or satellite,
- a digital-TV set, or
- a box that converts digital-TV signals for viewing on an analog set

Broadcasters may vacate the old TV channels earlier and are permitted to negotiate terms for early transition. Given the uncertainties of the plan the actual transition time is still in question.

Within Rhode Island, there is an incumbent television station in Providence [channel 64] operating within the new 700 MHz Public Safety radio spectrum allocations. This is also true for the neighboring states of Massachusetts and Connecticut where incumbent stations operating in this band preclude Rhode Island's use of the spectrum. Eventually, these stations will relocate their broadcast operations to their new digital television channel and will vacate the 700 MHz band.

It should be noted that there is also some 30 MHz in the 700 MHz band that will be made available to commercial interests, [as noted in the chart below]. This spectrum will be allocated via public auction. These auctions have been scheduled and then rescheduled due to ongoing issues with the

transition of the 700 band from TV broadcast to land mobile usage. Generally, a much lower level of interest has been exhibited by commercial entities in obtaining the spectrum, as contrasted with past auctions of other portions of the radio spectrum.

For public safety and state/local government operations, the amount of spectrum being released translates to some 1,920 individual 6.25 kHz frequencies, which yield 960 channel pairs. An additional 240 wideband (50 kHz) frequencies are part of the allocation. This aggregate allocation is equal to 3,640 6.25 KHz channels.

Regional Planning Committees [RPCs] will allocate most of the spectrum available at 700 MHz. The RPC's have been formed along the same geographic boundaries as in the 821 MHz band.

The National Coordination Committee [NCC] was established by the FCC to solicit input from the public safety community in the further development of rules governing the new 700 MHz public safety band, particularly with regard to interoperability. The work of the NCC is extremely important for many reasons, including the fact that this new band is to satisfy public safety communications needs well into the 21st century and is intended to provide the capability for a nationwide public safety interoperability communications system. As part of its charter, the NCC has released a number of reports to the FCC. Included in the reports were a number of items including the definition of the parameters for the allocation and use of the 700 MHz band and the selection of a common air interface for the interoperable (inter-agency) communications requirement. Many of the technical standards have been approved, including the common air interface for inter-agency communications interoperability.

The State of Rhode Island has an unusual opportunity to position itself at the forefront of this new communications and technological era. As the need for the delivery of state and local government services continues to rise, the need for expanded wireless voice and data communications will continue to grow as well. At this time, the frequency band that shows the most long-term promise for meeting the emerging wireless communication needs of the State agencies is the 700 MHz band. The FCC and radio equipment manufacturers are finalizing the details on the specific use and application of the new 700 MHz radio channels. Today, 700 MHz radio equipment is already available from the equipment manufacturers and operates in the 800 MHz band – dual band radios. In fact, the recently implemented RITERN network utilizes dual band radios.

From an historical perspective, even though there are some outstanding technical issues in the 700 MHz band, these are generally resolved. There has been however, apparently less progress in the business and political aspects of this process regarding the transition of the spectrum from TV broadcast to land mobile usage. The issues are quite complex and have involved a wide breadth of issues for the TV broadcasters, TV set manufacturers, and cable TV operators. These have ranged from the selection of a digital TV over-the-air broadcast standard, the setting of technical parameters of TV receivers, to first amendment rights concerning how cable TV companies are to carry any digital TV broadcast. In fact, some aspects of the transition have been brought before the US Supreme Court. Because of the many ongoing issues, there is less than a wholesale acceptance by the public of digital broadcast television. As an example, statistics from the year 2001 indicated that purchases of digital TV by the public was a miniscule four-tenths of one percent of all TV sets

purchased in the US. Because of these issues, the commercial interests that have been planning to participate in the public auctions have been less willing to expend funds on spectrum that may not be released in the near future.

Many who have followed the process feel that the 2006 date is more likely to be 2010, or even later. However, it should be noted that in some parts of the United States, the operation of 700 MHz for statewide land mobile operation would not be impacted by the lack of apparent progress of the TV industry.

Even with the current regulatory uncertainties, there is great promise in the 700 MHz band. Cities and counties are already beginning the planning process to obtain 700 MHz channels. The abundant availability of new 700 MHz radio channels, a well-ordered set of technical operational parameters, and new emerging radio technologies [APCO Phase-II] are just now making their way to the marketplace, will drive many Public Safety users to take advantage of the new spectrum and technologies in the future.

900 MHz Band

In the late 1980s, the FCC released spectrum in the 900 MHz band to commercial, business, and industrial radio users. Public safety and local government usage of these channels was not included in this allocation. Throughout the years, some of these systems, especially those employed by electric utilities, have expanded to cover large areas. In many cases, these utilities have offered two-way (trunked) radio communications to city and county governments for a fee. Not all of these shared utility systems operate at 900 MHz; some operate at 800 MHz and/or use a mixture of 800 and 900 MHz technology.

FCC Narrowband Mandate [Refarming]

In recognition of the growing lack of radio frequency resources, the FCC began an initiative in the early 1990's to "produce more radio channels" or to effectively increase the number of channels available to the public. The FCC termed this program as "refarming", that is, the current frequency resources would be rearranged or "refarmed" to produce more radio channels in the VHF and UHF radio bands. (The refarming process did not affect the less desirable low band radio channel allocations).

The refarming concept involved inserting or establishing an interstitial (intermediate) channel between each of the existing channel allotments. In order to fit between the two existing frequencies, this newly created frequency would have to be "narrower" and therefore would be limited to a narrow-band occupancy requirement. The existing wide-band frequencies supporting wide-band operations on each adjacent frequency would not initially be required to change to narrow-band operation. This is a departure from past practices, where narrow banding of the spectrum was required by all licensees.

FCC Refarming Plan

The FCC refarming plan is implemented in two [2] phases. The first phase is to reduce the channel bandwidth from 20 kHz to 11.3 kHz beginning January 1, 1996. The second phase requires another

split from 11.3 kHz to 6kHz and is set to occur in January 1, 2005.

Under Phase-1, the FCC required, through its type acceptance process, all new radio equipment to have a narrow-band option to operate with 11.3 kHz bandwidth. (Type acceptance is the process by which the FCC requires equipment manufacturers to certify that their equipment meets FCC specifications). Manufactures are still able to offer radio equipment that provides backward compatibility to original the 20 kHz wide-band emissions, but all equipment manufactured since 1996 is capable of 11.3 kHz operation due to FCC regulation.

For Phase-2, the FCC's refarming order requires that in the year 2006, all new radio equipment must be capable of operating at 6 kHz bandwidth. However, the equipment shall be backward compatible with both 20 kHz and 11.3 kHz channel bandwidths. Currently, and in the foreseeable future, no radio manufacturer has yet produced equipment that can operate on this very narrow bandwidth. The FCC recently has waived this narrowband requirement in the 700 MHz band until 2015. As the industry approaches the 2006 timeframe for narrowbanding, RCC expects that manufacturers will requests FCC waivers to extend the timeframe for the VHF and UHF bands.

The VHF (150-174 MHz) band follows the same band plan as does UHF with one important exception. The existing 20 kHz operation already overlaps current 15 kHz allocations. The new "refarming" frequencies spaced at 7.5 kHz, and operated with 11.3 kHz bandwidth, increases the interference susceptibility. Geographic spacing (separation) between adjacent channel licensees is the only current means to permit utilization of this spectrum. In urban areas, where spectrum is needed most urgently, there is usually insufficient separation to utilize the new narrowband frequencies without causing harmful interference.

FCC Refarming Timetable – Recent Activity

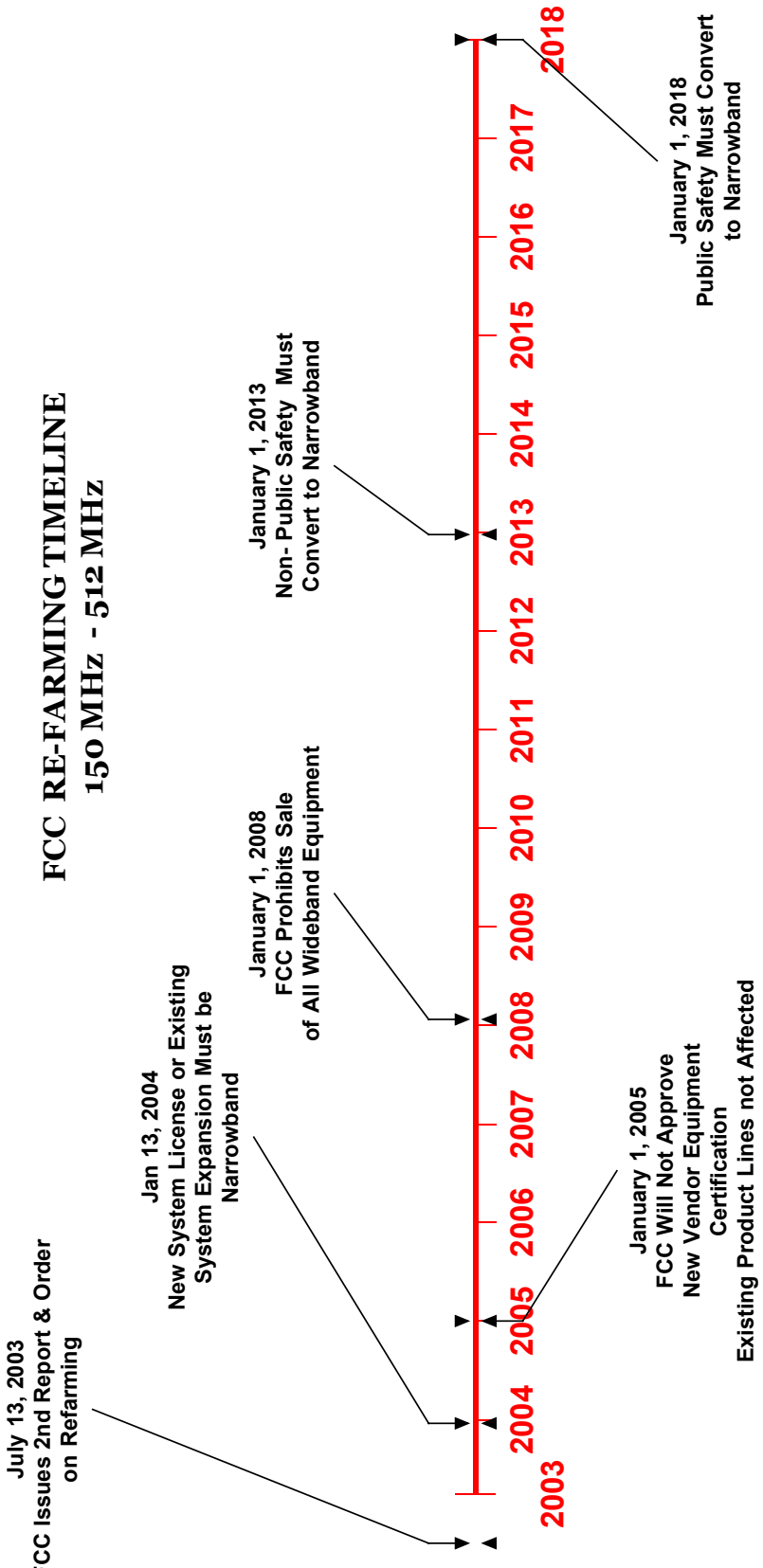
Since 1992, the FCC has not required that current licensees in the VHF and UHF bands to migrate to narrowband equipment. Instead, the FCC depended upon the need for additional spectrum by the users by driving them to adopt the use of narrowband frequencies and equipment as their current equipment wore out.

Recently however, on February 25, 2003, the FCC released its Second Report & Order on Refarming – Docket 03-34. The FCC is now mandating migration to 12.5kHz [11.3kHz occupied bandwidth] channel operation in both the VHF and UHF frequency bands [150 – 512 MHz] based on the timetable shown below. The FCC is also restricting new systems, and existing systems that require expansion.

Date	Event
Jan 13, 2004	FCC will not accept new applications for 20 kHz bandwidth channels.
Jan 13, 2004	FCC will not accept major modification or expansion of existing systems/frequencies that have bandwidths greater than 11.25 kHz
Jan. 2005	FCC will not approve new vendor equipment with backward capability to 20 kHz bandwidth channels. Existing product lines are not affected.

Jan. 2008	FCC will prohibit 20 kHz bandwidth operation of all vendor equipment.
Jan. 2013	Non-Public Safety radio users prohibited from using 20 kHz bandwidth equipment – must be converted to 11.25 kHz equipment.
Jan. 2018	Public Safety radio users prohibited from using 20 kHz bandwidth equipment – must be converted to 11.25 kHz equipment.

Furthermore, in conjunction with the Second Report & Order, the FCC released its Second Notice of Proposed Rulemaking seeking comment on whether to migrate the industry to one voice path per 6.25kHz bandwidth [or equivalent digital technology], and whether this efficiency standard should be mandatory.


FCC RE-FARMING TIMELINE
150 MHz - 512 MHz
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
July 13, 2003
FCC Issues 2nd Report & Order
on Refarming
Jan 13, 2004
New System License or Existing
System Expansion Must be
Narrowband
January 1, 2005
FCC Will Not Approve
New Vendor Equipment
Certification
Existing Product Lines not Affected
January 1, 2008
FCC Prohibits Sale
of All Wideband Equipment
January 1, 2013
Non- Public Safety Must
Convert to Narrowband
January 1, 2018
Public Safety Must Convert
to Narrowband

How FCC Rule Changes Affects Rhode Island

All of the Rhode Island state and local public safety radio systems licensed between 150 MHz and 512 MHz are affected by this FCC rulemaking.

Typically, existing public safety radio equipment operates wideband channels on 20 kHz bandwidths. This equipment will have to be replaced with new narrowband radios operating on 11.3 kHz bandwidths before 2018. Certainly enough time to complete existing equipment lifecycles. However, if any of the radio systems are modified, such as adding or relocating radio sites, then narrowband conversion may be required. This requirement is mandatory for all licensees.

Many agencies have already begun to convert their systems to narrowband. Any radio equipment that has been purchased since 1996 is dual mode. That is, they are capable of operating on both 20 kHz and 11.3 kHz bandwidths.

CHANNEL EXPANSION, SYSTEM LOADING AND SYSTEM ISSUES

Expansion of RIDOT Channels to RIPTA Sites

As discussed in the previous section, Rhode Island has several 800 MHz channel allocations in both the 806 MHz and 821 MHz band. The RIPTA system consists of four [4] 821 MHz channels, although they are licensed for fifteen [15] channels. The remaining eleven [11] channels are in "reserve" or may be assigned to the proposed Washington County trunked radio network. All 15 channels are licensed at RIPTA's seven [7] transmitter sites. RIDOT has five [5] 806 MHz channels licensed at two [2] sites. An analysis was conducted to determine if the DOT channels could be licensed on the RIPTA radio sites. The results are found in the table below.

One of the five RIDOT's channels has an FCC freeze and the service area cannot be changed [FCC froze channels below #150]. The other five channels would have difficulties in licensing to the RIPTA sites under the FCC short-spacing rules [between 55 and 70 miles]. FCC would require that the co-channel licensee be notified and that the service and interference contours not overlap. In addition, there may be a reduction in transmitter power levels. The existing co-licensee can object to the re-location. Most of the co-channel problems are with Nextel.

These Nextel licenses will go away if the FCC approves rebanding and Nextel is moved out of the 806 band. At that point, some of the 806 channels may be available for license. This is the current expectation of public safety that more channels will be available with rebanding.

SITE	CO-CHANNEL DISTANCE [miles]	CO-CANNEL LICENSEE	LICENSABLE UNDER SHORT-SPACE RULES
S. Kingston	53.4	Nextel	None
Exeter	49.7 & 58.8	Nextel & Airinc	4 of 5 channels
Scituate	45.4 & 52.6	Nextel & Airinc	3 of 5 channels
Portsmouth	39.6	Nextel	None
Cranston	51	Nextel	None
Cumberland	55 & 57	Nextel & Anheuser-Busch	4 of 5 channels

FCC Loading Regulations

In order to ensure that assigned radio channels are used efficiently, the FCC requires licensees to have a minimum of 100 radios operational for each 800 MHz channel authorized. For example, a 5-channel trunked radio system must be loaded to a minimum of 500 users. The maximum number of channels authorized is twenty [20].

FCC rules allow a period of up to five years from the date of original license grant to meet this loading requirement. At the end of five years, the authorization for those channels that are not loaded to 100 units per channel may be canceled. Cancellation depends upon whether all available channels are already assigned. If there are no other channels available, the FCC could reassign some of the State's channels that are not loaded to 100 units per channel to someone else requesting spectrum.

In addition to the loading requirements, the FCC generally specifies that a licensee must have the system's infrastructure, i.e., towers, repeaters, etc. on the air within one year of the license grant.

Fortunately, the FCC also provides a three-year slow-growth option for Public Safety and Local Government users who may need more than a year to plan, fund, and implement such a system. Under the slow-growth plan, a licensee has up to three years to construct the system and have it operational, and is required to submit yearly implementation plan reports to the FCC.

Required System Capacity

A more critical analysis is the busy-hour analysis used to determine how many subscribers that the system can handle without violating a grade-of-service [GOS] requirement.

In considering traffic analysis for trunked radio systems, the concepts of loading, traffic, grade-of-service, and wait-times are briefly discussed below. It is important to remember that traffic theory, even when using actual measured data, is based on probability and assumptions. Even if the best processing methods are used, and the best data is obtained, solutions to traffic problems are still only an indication of the probability of congestion.

Loading refers to the radio system's ability to accommodate the maximum number of talkpaths under all types of operating conditions. To accommodate radio traffic successfully, there needs to be sufficient number of channels to meet user demands. Airtime traffic is measured in dimensionless units called Erlangs[25]. Erlang data is used to "size" new systems or to characterize traffic on existing networks if certain parameters are known.

The number of channels required in a system is also dependent upon the grade-of-service [GOS]. GOS is simply the probability that a percentage of radio traffic will be blocked or delayed. It is the ratio of the number of blocked calls to the number of call attempts. A GOS of P0.01 [1%] indicates that 1 in 100 calls is blocked. Traffic analysis can also be expressed in terms of delay or wait-time stated in terms of delay-seconds. Usually the shorter the average waiting time requirement, the more channels are needed to fulfill this requirement. For public safety performance, a GOS of 1% and an average wait time of 5-seconds or less is specified[26].

The concept of traffic analysis has multiple variable dependencies. Some variables that are included in the calculations are as follows:

- Maximum wait time
- Average message length
- Number of channels available
- Number of talkgroups
- Unit priority in system
- Equipment latency, such as repeater hang-time, analog-to-digital conversion, etc.
- Radio user population

The last item listed, which is the total population served, varies greatly from one period to another. Traffic is not uniform in any manner, but is according to the needs of the users. Traffic volume varies year-by-year, day-to-day, and hour-to-hour.

System Loading Assumption

- 20-channel trunked system utilizing message trunking
- 1,345 subscribers four [4] core agencies only
- 7,321 subscribers for all agencies statewide
- Assumes 70% units active. That is, some users may have both a mobile unit and portable radio where only one will be used, etc.
- During the busy hour:
  - 60% system traffic are emergency calls
  - 40% system traffic is non-emergency calls
- Includes 20% additional loading due to peak busy average over year, digital delays, talkgroup delay, etc.
- Use Erlang-C calculation
  - Core Agencies – 5.4 Erlangs
  - All Agencies – 24.9 Erlangs

[25] For a single channel system, 1-Erlang by definition is 60 minutes (3,600 seconds) of traffic in one-hour. For an example, an Erlang of 0.5 signifies that 30-minutes of a 1-hour period is occupied by traffic. An Erlang greater than 1 implies the hour is used up and additional channels are required to support communications.

[26] In terms of public safety standards for GOS and waiting times, APCO commissioned ITT in 1969 to study police telecommunications systems under APCO Project-3. The study resulted in the specifications stated in this report.

This analysis takes into consideration the following assumptions:

- 12-seconds message length
  - assumes average of four [4] push-to-talk [PTT] transactions per message in the busy hour
- Calls per busy hour
  - Emergency calls per hour = 2
  - Non-Emergency calls per hour = 1
- Erlangs per mobile
  - Emergency = .oo7 Erlangs
  - Non-Emergency = .oo33 Erlangs
- Grade-of-Service: Less than 5-second average wait time [in queue]

	AVE. DELAY ON CALLS IN QUEUE DURING BUSY HOUR		
Traffic in Erlangs Based on 12sec msg	**Number of Channels required for less than 2-seconds of delay**	**Number of Channels required for less than 5-seconds of delay**	**Number of Channels required for less than 10-seconds of delay**
5.4 E Core Agencies	12+1	8+1	7+1
28.3 E All Agencies	34+1	30+1	29+1

BUSY-HOUR

Average delay on delayed calls: When the system server is busy, a calling unit is placed in a queue and the call is delayed some finite time period until the system server can service the call.

Note: The +1 indicates a system control channel requirement

System Capacity Conclusions

Based on the traffic loading analysis, it appears that the total number of radio channels for the projected subscriber population for all agencies is 32-channels. This is based on the estimated subscriber population of 7,321 units. The actual number of subscribers needs to be inventoried to verify calculations. For the four core agencies only, 13-channels are adequate to provide a 2-second or less queuing delay.

Key Considerations:

- RIPTA and DOT are licensed for twenty [20] 800MHz channels. However, several of the DOT channels cannot be re-licensed to RIPTA sites, which reduces the total number to 15 channels. This would cover the Core Agencies only and additional channels may be required.

- Motorola Smartnet systems are capable of 28-channels maximum, to increase capacity a system overlay would be required.

6.0 CONCEPTUAL SYSTEM DESIGN

For the reader who desires more technical detail regarding current and future public safety system technologies, RCC has provided the State of Rhode Island under separate cover a full technology assessment report.

CURRENT BACKBONE ARCHITECTURE

The chart below briefly summarizes the status of the public safety trunked systems in Rhode Island.

System	Status	Architecture	No. Sites	Coverage
DOT	Currently In service	Motorola Smartnet	2	Statewide Mobile
RIPTA	Testing Phase	Motorola Smartnet	7	Statewide Mobile
DOC	Currently In Service	Uniden[27]	1	Cranston Area Mobile & Portable
Washington County	Conceptual Plan Only	APCO25[28]	5	Washington County Portable

Motorola's advanced trunking product is known as "SmartNet", the most recent version is referred to as "SmartNet II". SmartNet II is capable of supporting up to 28 radio channels per site. One channel in the SmartNet system is designated as the control channel on which the signaling for channel assignments is transmitted and received. The control channel provides data signaling at 3600 bits per second. Both the DOT and RIPTA systems are Smartnet-II systems.

For the proposed Washington County system, Motorola's APCO Project-25 compatible digital trunked network, known as Astro-25 that utilizes a 9600 BPS control channel, would be bid. All data communications uses IP messaging and Astro-25 radios provide a data port for connecting a mobile computer so they can be used as radio modems in addition to being voice radios. In addition, the Astro-25 radios are backward compatible with both the RIPTA and DOT systems. However, RIPTA and DOT subscriber units will not be capable of communicating directly on the proposed Washington County system. Therefore, a gateway will be required to establish common talkgroups between both networks.

[27] The DOT and RIPTA system backbone are not compatible with the DOC system.

However, due to the difference in control channel signaling, the Astro-25 and Smartnet-II networks are not compatible and would require a gateway for inter-system interoperability.

Furthermore, Smartnet systems are limited to only 10-sites [Astro-25 systems can accommodate 15-sites]; therefore, to construct a 17-site system would require networking two systems or reducing some of the low traffic density sites to Intel repeater operation only.

It is proposed that the Washington County system be used as the platform to expand the network statewide when resources become available.

COMMON RADIO SYSTEM SUPPORTING INFRASTRUCTURE

Site Facilities

Radio system planners in RI have diligently maintained state-of-the-art radio site infrastructure. While most communication infrastructures currently in place have been upgraded over the past 5 to 7 years; that is, communications shelters, towers, emergency generators, etc. have been replaced or upgraded, there are additional facilities that need to be added, replaced or upgraded in a system expansion.

Microwave Radio

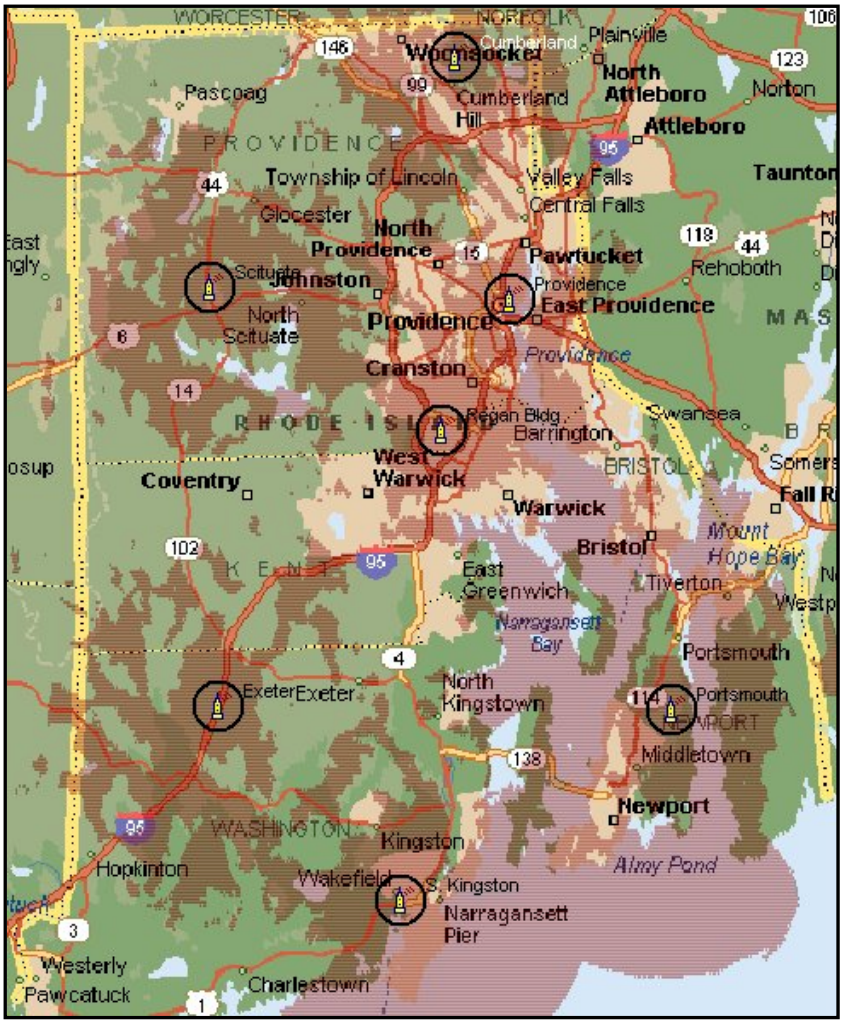
As discussed in previous sections, microwave radio systems and leased line services are the predominant method for supporting radio site connectivity throughout the state. It is a critical supporting infrastructure. However, the microwave system is approaching capacity, and the vendor has suspended supporting the current equipment. System expansion will require the replacement of the microwave backbone.

800MHz Coverage Issues

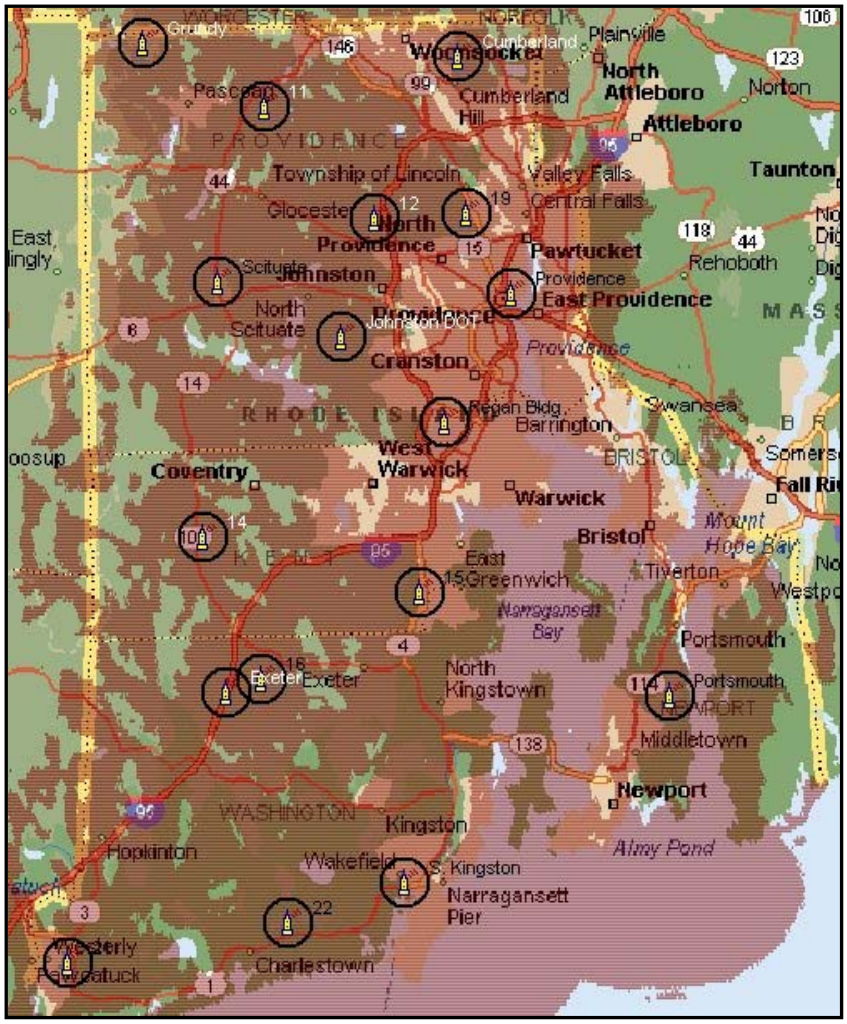
For reliable public safety communications, the coverage specification is altered. That is, the coverage requirement is changed from 90% mobile coverage to 95% hand-held portable coverage inside of residential buildings. As a result, the number of radio sites is increased from seven [7] to seventeen [17]. The maps found on the next page show before and after results of the new coverage specification.

Of critical importance to Rhode Island is in-building coverage. RCC recommends "predictive analysis" upfront for planning in-building coverage. This analysis should be done by the prospective vendor prior to submitting their proposal.

Predictive analysis would ensure the proper placement of communications towers for maximum coverage efficiency. In addition, all critical and high life-safety buildings in the State would be identified and assessed in 3-1 categories. Some in-building measurements may be required in specific buildings, that data would be used to interpolate adjacent or nearby buildings. Future commercial and development growth areas would need to be identified to maximize an in-building signal penetration design.



Projected RIPTA In-Building Coverage
At Existing Sites – 95% Reliability
Coverage Area Shown in Red



Projected Site Configuration Required
For 95% Portable Coverage Inside
Residential Building / 17-Sites
Coverage Shown in Red

STATEWIDE NETWORK IMPLEMENTATION PLAN

The State's desire of providing a fully interoperable statewide communication system for all state and local public safety and public service agencies is contingent upon a system design that will:

- Support the immediate needs of the four [4] core state agencies [RISP, DEM, DOT and RIPTA]
- Support the communication needs of other State agencies
- Support the communications needs of local cities and towns
- Support communication paths with existing systems until these agencies are ready to migrate onto the statewide system
- Efficiently accommodate new agencies onto the system
- Utilize existing agency resources to minimize the cost of new system infrastructure
- Encourage long-term cost savings to the participating agencies and reduce total spending of public funds

Standardization of Equipment

Rhode Island's goal of an integrated interoperable statewide wireless voice and data communications network necessitates some equipment standardization. That is, some equipment performance criteria should be adopted to ensure interoperability, and for future successful migration to a statewide network.

There is currently a substantial investment in infrastructure and subscriber equipment that warrants such a standard. RITERN, RIDOT, RIPTA, and the proposed Washington County networks are the platforms [800 MHz] that a statewide network will grow from to achieve full interoperability. Furthermore, with the 700 MHz frequencies becoming available in the future, augmenting the State's current spectrum allocation, should focus the state to some technical standard.

The standard for subscriber equipment should be dual-band [700\800 MHz] Project-25 compliant radios. The ability to communicate between and among public safety agencies is fundamental to effectively providing public safety services. In day-to-day routine activity, such as traffic accidents or sporting events, frequently require the coordinated resources of state and local agencies. Area flooding and snowstorms necessitate joint responses, these may include RIDOT, EMA or several other public safety agencies. Searches for missing persons, mass casualty incidents, or multiple alarm fires necessitates effective interoperable communications.

Equipment standardization among the several public safety agencies is critical to coordinating effective responses to these and other life threatening incidents. Today, in Rhode Island, incongruous technologies and the lack of standardization by public safety agencies obstruct statewide interoperability.

PROPOSED MIGRATION ROADMAP – RECOMMENDATION

Overall, there are a wide variety of design approaches and considerations that must be addressed and resolved in the actual detailed design of the proposed system. The following suggested multi-year, multi-phased approach is based on conceptual design level; however, it is subject to change, based on final design criteria selected by the State of Rhode Island.

While final design decisions by the State could alter the sequence of departments/agencies going onto the network, as well as the length of the schedule to more or less years, a plan such as this allows a gradual transition into the new technology.

1. ***Spectrum Recommendations***
    a. Currently, there is sufficient 800 MHz spectrum for only the four [4] core State agencies
    b. Current RI 800 MHz spectrum allocation is insufficient for statewide radio network for all agencies
        i. 15-channels licensed statewide
            1. RIPTA utilizes 4-channels
            2. 11-channels are currently in reserve
                a. 4-channels for Washington County [minimum]
                b. 2-channels for Mobile data system
        ii. DOT channel not capable of being expanded statewide
            1. Licensed for 5-channels
            2. Co-channel licensees [mainly Nextel], are too close for FCC short-spacing re-assignment
            3. Some channels may be used for local coverage only or fill-in coverage utilizing Intelli-repeaters
    c. Begin process of identifying additional 821 MHz [NPSPAC] spectrum that may be available to Rhode Island
    d. 700 MHz spectrum not available until 2010 – current estimate

2. ***Procure and implement Washington County [WC] 800 MHz Trunked Radio Network***
    a. APCO-25 system [digital voice]
        i. Coverage design should be for 95% coverage reliability for hand-held portable inside of residential buildings
        ii. 5-site system
        iii. 4-channel system [minimum]

iv. Expand microwave system
v. Supports up to 300 users
vi. New towers and shelters required
vii. New communication consoles required
viii. Subscriber units capable of operating on DOT and RIPTA systems but not vice-versa

b. This network to be expanded statewide in a multi-phase approach

3. Begin planning and designing a new statewide mobile data network

a. Existing Verizon CDPD service being discontinued by 2005
b. Plan, procure and implement new mobile data backbone system
   i. Mobile-only system
   ii. Utilizes seven [7] sites
   iii. Utilize two [2] statewide 800MHz channels
   iv. 19.2 kbps backbone
   v. Requires new RF modems in vehicles
   vi. Existing laptop computers can migrate to the new network

4. Buildout NPSPAC sub-network statewide and institute statewide operational plan [National Interop Channels per FCC and Region-19 requirements]

5. Establish common Washington County, RIPTA, and DOT talkgroups

a. Allows mobiles and portable units to roam between both systems
   i. Set up inter-system talkgroups
   ii. Set up intra-system talkgroups

6. Begin site acquisition process for new tower sites to expand Washington County system coverage to the remainder of the State.

a. Expansion from 5-sites to 17-sites for 95% hand-held portable coverage inside residential building.

8. Expand and replace microwave network and site facilities

a. Vendor no longer supports current equipment
   i. Parts availability problem
b. Microwave system near capacity at certain nodes

c. New microwave links will be required for new communications sites
d. New towers, shelters, generators, etc. required for new sites
e. Equipment includes RF terminals and channel multiplex

7. Monitor FCC activity regarding the re-banding of public safety 821 MHz channels. Outside funding may be available to RI for system modification and\or expansion

9. Begin expanding Washington County trunked system to new sites

a. Purchase and install new network equipment
b. Purchase and install new communications consoles

10. Migrate RISP, RIDOT, DEM, DOC and other state agencies to new network

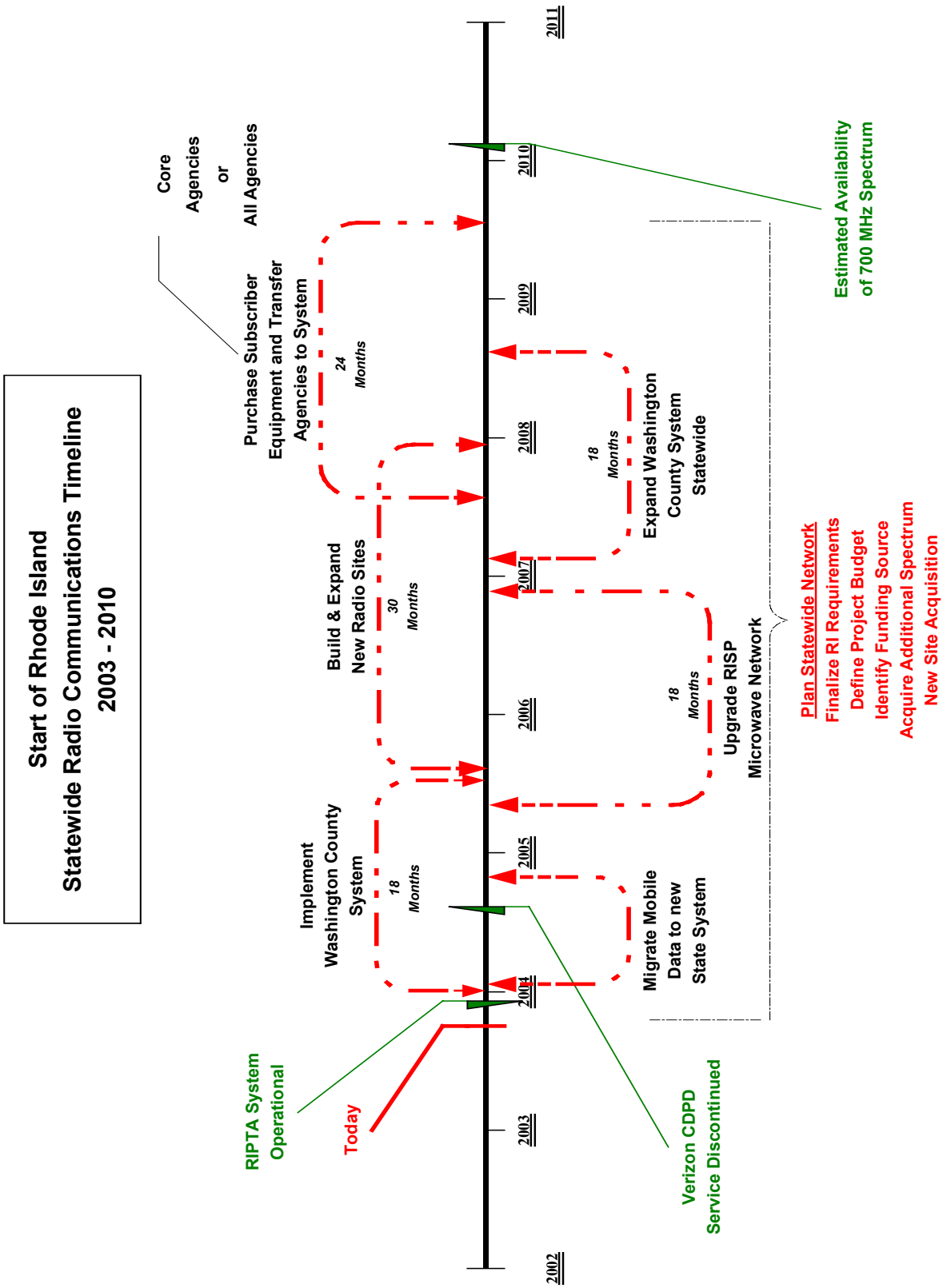
a. Purchase of mobiles and portable radios
b. Migrate RIPTA to new network when subscriber equipment reaches their lifecycles
c. When RIPTA migration is completed, transfer the four [4] RIPTA channels to Washington County system

11. Monitor FCC activity regarding the release of new 700 MHz spectrum for RI

12. Begin planning and designing 700 MHz system overlay

a. Plan, design, procure and implement system upgrade\expansion for 700 MHz
b. Expand network for all state and local agencies
    i. Purchase of mobiles, portables, and control stations
    ii. Communications consoles as required

Refer to the timeline diagram shown on the next page identifying major milestones.


Start of Rhode Island
Statewide Radio Communications Timeline
2003 - 2010
Core
Agencies
or
All Agencies
Purchase Subscriber
Equipment and Transfer
Agencies to System
24
Months
Build & Expand
New Radio Sites
30
Months
Implement
Washington County
System
18
Months
Migrate Mobile
Data to new
State System
18
Months
Upgrade RISP
Microwave Network
18
Months
Expand Washington
County System
Statewide
Plan Statewide Network
Finalize RI Requirements
Define Project Budget
Identify Funding Source
Acquire Additional Spectrum
New Site Acquisition
Estimated Availability
of 700 MHz Spectrum
RIPTA System
Operational
Today
Verizon CDPD
Service Discontinued
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011

7.0 ESTIMATED BUDGETARY COSTS

The following suggested multi-year, multi-phased approach and associated costs are based on conceptual level, budgetary estimates. RCC believes these estimated costs are realistic in 2003 dollars; however, they are subject to change, based on final design criteria selected by the State.

The projected cost is not based on any specific vendor offering, but on the best industry available average estimates. Actual cost resulting from the final design, the competitive bid process, and vendor discounts may differ.

Cost estimates include engineering, integration, installation project management, and training services.

COST SUMMARY

SUB-SYSTEMS	Low Estimate	High Estimate
Washington County System	$6,060,000	$7,190,000
Mobile Data Network	$4,623,000	$7,647,000
NPSPAC Channels	$140.000	$175.000
New Site Facilities	$3,380,000	$5,150,000
Microwave Replacement/Expansion	$5,540,000	$7,310,000
Expand WC Trunked System Infrastructure Statewide	$17,480,000	$20,220,000
Subscriber Radios Core Agencies Only [excludes RIPTA] 1,005 radios	$3,216,000	$3,718,000
Subscriber Radios All State & Local Agencies [excludes Core, WC & RIPTA] 5,336 radios	$17,075,200	$19,743,200

Total System Cost

800 MHz Radio and Data Network Infrastructure and Subscriber Units

Core Agencies Only Statewide Trunked Simulcast Radio	$40,439,000	$51,410,000
Core, State & Local Agencies Statewide Trunked Simulcast Radio	$57,514,200	$71,153,200

COST BREAKDOWN

WASHINGTON COUNTY TRUNKED RADIO SYSTEM

	Estimated Expenditures	
Item	**Low Estimate**	**High Estimate**
3 new site facilities: land/leases/tower/shelter/gen, etc.	$ 660,000	$ 960,000
5-site trunked simulcast equipment	$3,500,000	$4,000,000
Three microwave hops/RF, multiplex/UPS	$ 660,000	$ 810,000
300 Mobiles and portables	$ 960,000	$1,080,000
Contingency – assume 5% equipment cost	$ 289,000	$ 342,000
Total Capital Costs Washington County Trunked Radio System	**$6.06 million**	**$7.19 million**

MOBILE DATA SYSTEM

	Estimated Expenditures	
Item	**Low Estimate**	**High Estimate**
RF terminals – 2 per site	$350,000	$490,000
Network Controllers for 7-sites	$420,000	$560,000
Message Switch	$0	$0
300 Mobiles - convert	$300,000	$900,000
Add 700 Mobile Computers	$3.500,000	$5,600,000
Contingency – assume 5% equipment cost	$53,000	$97,000
Total Capital Costs Mobile Data System	**$4.62 million**	**$7.65 million**

NPSPAC NATIONAL CHANNELS

	Estimated Expenditures	
Item	**Low Estimate**	**High Estimate**
RF terminals – 2 per site	$140,000	$175,000
Total Capital Costs NPSPAC National Channels	**$140,000**	**$175,000**

SITE EXPANSION

	Estimated Expenditures	
Item	**Low Estimate**	**High Estimate**
14 new sites: land/surveys, etc.	$ 140,000	$ 420,000
14 site facilities: towers/shelters/gen./HVAC/sitework	$3,080,000	$4,480,000
Contingency – assume 5% equipment cost	$ 160,000	$ 245,000
Total Capital Costs	**$3.38 million**	**$5.15 million**

Site Expansion

MICROWAVE SYSTEM REPLACEMENT AND EXPANSION

	Estimated Expenditures	
Item	**Low Estimate**	**High Estimate**
Microwave: 24hops/RF terminals/multiplex/alarms,etc.	$5,280,000	$6,960,000
Contingency – assume 5% equipment cost	$ 265,000	$ 348,000
Total Capital Costs **Microwave System Replacement and Expansion**	**$5.54 million**	**$7.31 million**

EXPAND 800 MHZ TRUNKED SYSTEM INFRASTRUCTURE STATEWIDE

	Estimated Expenditures	
Item	**Low Estimate**	**High Estimate**
Expand trunked simulcast equipment 12-sites	$9,000,000	$10,200,000
Contingency – assume 5% equipment cost	$ 450,000	$ 510,000
Subscriber units		
Core Agencies Only – 1,005 radios Excludes RIPTA	$3,216,000	$3,718,000
All State & Local – 5,336 radios Excludes Core, WC & RIPTA	$17,075,000	$19,743,000
Total Capital Costs **Statewide 800 MHz Infrastructure**	**$29.7-million**	**$34.2-million**

System Phase-In

In order to help with the significant costs associated with a statewide buildout of the multiple elements of the project, the system could be implemented in several phases. These phases are shown on the timeline diagram found on page-29.

Phase-in could be implemented in a "slow growth", multi-year approach for the transition to a complete a shared statewide radio system. The implementation of the new statewide radio system could begin at once, since FCC licenses are already granted. However, the process of preparing and submitting budgets for the proposed system, and the approvals to provide funding for capital expenditures, could take several months or years.

The table found on the next page identifies tasks to implement based on funding. While final budget decisions by the State of Rhode Island could alter the sequence of tasks [more or fewer years] onto the network, this allows a gradual transition into the new technology.

Sub-Systems	Year	Cost Using High Estimate	Comment
Washington County System	1/2004 to 6/2005	$7,190,000	Includes trunked radio and microwave infrastructure; new towers & shelters; 300 subscriber units
Mobile Data Network	6/2004 to 6/2005	$7,647,000	New statewide wireless data infrastructure; upgrade existing computer and vehicular modems for 500 units; add 700 more units to network
NPSPAC	Same	$175,000	FCC/Region-19 Requirement
New Site Facilities	6/2005 to 12/2008	$5,150,000	New site acquisition; towers, shelters, etc. to expand microwave and radio sites for portable coverage; 30-month effort overlaps multiple tasks
Microwave Radio Upgrade and Replacement	6/2005 to 12/2006	$7,308,000	Replaces obsolete microwave equipment and expands network
Expand Washington County Network Statewide	1/2007 to 6/2008	$10,710,000	800 MHz radio infrastructure only for statewide simulcast system
Purchase Mobile & Portable Radios	6/2008 to 12/2010	$23,461,000	6,341 total radios; cut-over appropriate agencies

8.0 MULTIPLE AGENCY SYSTEM GOVERNANCE

The development and implementation of any statewide wireless communications system is a significant undertaking that will require a multi-year approach to funding and implementation of the project. The implementation process will differ depending on which alternatives are chosen by Rhode Island. Obviously, the implementation of a shared statewide communications system infrastructure by a multitude of State and Local Agencies is considerably complicated. The additional complexity arises from the need for a more complex system infrastructure and the need to coordinate those factors, which affect the day-to-day operations of the participating agencies.

SYSTEM OWNERSHIP

Because it is extremely difficult for multiple independent agencies to collectively manage a shared communications infrastructure, most states that have developed such systems have selected a single entity to oversee and manage the system – and have system ownership. This single entity can be most effective if it is involved in the development, procurement, and implementation of the system. It will also circumvent financial and operational implications that may emerge during those phases. The detailed information gathered during these phases of the project will be invaluable in the ongoing maintenance and support of the network.

A strong multi-layer organizational infrastructure will be required to support the implementation and long-term management of the State's wireless communications solution. A key State agency with ownership and/or management responsibilities can provide the necessary strong leadership and guidance.

In addition, it is recommended that a User Group of participating agencies and departments be implemented to provide direction on day-to-day system operation and other administrative issues.

POSSIBLE GOVERNANCE AND SYSTEM SUPPORT SCENARIO

Establish a Board of Directors, or an Executive Committee, from a consortium of participating agencies for the new system. This group would have responsibility for organizational structure, institute policies, identify funding sources, provide financial oversight, and cost sharing or apportionment methodology.

This governing body would oversee a Users Group, or Communications Working Committee [perhaps the current CWG] that would address user needs, funding/financing, network operation, and maintenance. To address the needs of all participants, the group should ensure that both large and small agencies\departments and all disciplines are adequately represented.

The Communications Working Committee would provide field level input for both system design and development of policies and operational standards. This Committee would be comprised of representatives from each of the participants on the new communications systems. Other responsibilities would include the oversight of system planning, budgeting, staffing, administration

and conflict resolution. Separate sub-committees may also be considered for voice users, mobile data users, and data users.

System Maintenance

Current and emerging technologies are complex and require more sophisticated maintenance than ever. Radio systems are not merely stand-alone repeaters and base stations, but integrated networks with multiple points of connectivity. For many components, the hardware capabilities and parameters are software-defined. System maintenance will need to be performed by a provider that has both the expert technical knowledge to support current technology and the ability to be trained to support emerging technologies in a cost effective manner.

To assist the Communications Working Committee, the Board of Directors shall select an appropriate lead State agency to be the System Manager. The System Manager's primary function is to oversee daily operations. However, it would assist in the system development, provide technical support, and be responsible for maintenance of the new system.

The statewide radio system will require considerable ongoing maintenance and repair, diagnostics support, system testing, software support, interference mitigation, and tuning. Furthermore, other management issues, such as regulatory compliance and training of system users are also a strong requirement.

There is no current state agency with the appropriate structure and staffing that can provide the necessary technical support for the new system. Therefore, the appointed System Manager would establish a technical support staff to manage the system on a daily basis and to oversee system maintenance. Direct equipment maintenance could be provided in-house [self-maintained] or contracted with a third party with the assistance of depot-like repairs. Many large-scale radio networks utilize the State's communications staff as the first-line of maintenance and call in contracted technicians to troubleshoot and perform actual repairs.

The radio system and supporting sub-systems will be a complex, advance-technology network that will require a Network Operation Center [NOC] to monitor critical system equipment, key operational features, and system performance. The facility can also serve as headquarters facilities for the proposed technical staff.

Long term maintenance and system support will require significant initial investment to set up operations, and for continued ongoing maintenance.

Cost Apportionment

Since the proposed system will be used by many agencies, it may be necessary to determine an equitable means of distributing the costs among the participating agencies.

In any mobile radio system, the equipment may be divided into two categories; the fixed equipment, and the subscriber equipment. Fixed equipment includes such items as repeaters, base stations, antennas, trunked system controllers, and backbone equipment such as microwave. Subscriber equipment includes such items as mobile radios, portable radios, or dispatch consoles.

Because of the division of equipment into these two broad categories, it is possible to allow each participating agency to bear the costs of its own subscriber equipment, while apportioning the costs of only the fixed equipment and supporting infrastructure.

There are several means available for apportioning the costs of the fixed equipment among many users. The most obvious method is to divide the costs equally among all participating agencies. However, there is a wide variation of size, and potential usage among the potential user agencies. A second possible means of cost apportionment is to assess each agency a portion of the cost based on their percentage participation in terms of the number of field units. For example, in a shared system with 1000 subscriber units, an agency with 100 units would contribute 10% of the costs of the fixed network. A possible problem with this arrangement is the fact that not all user agencies will contribute equally to system loading [use of system].

For an example, an agency that operates on a 24-hour basis, such as public-safety agencies, will contribute approximately 3 times as much overall system loading per field unit as an agency that only operates during a normal 8-hour shift. Therefore, a weighted apportionment scheme may be applied. In this approach, an agency that operates on an 8-hour basis may be assessed one point per field unit. Another agency, which operates on a 24-hour basis, may be assessed 3 points per field unit. The total assessment per agency would then be represented by that agency's percentage of the total points.

However, it may be further argued that airtime is the only true indicator of system usage by agency. Due to the nature of digital signaling systems employed in trunked radio systems, it is possible to account for the actual airtime usage per agency [per subscriber] on the trunked system, and charge each agency in accordance with the measured airtime. This is the method employed by Specialized Mobile Radio (SMR) systems in order to bill each of their customers.

Although the airtime billing method may seem to be the most equitable, there are several items to be considered. First is the fact that the proposed statewide radio system must deal with the initial construction and implementation costs, as well as the yearly operation and maintenance costs. Since construction costs must be paid before any users go on the air, this method could not be used to determine each agency's share of these costs.

When considering the cost of the fixed infrastructure, it should be remembered, that this includes such additional items as site development, site improvement, mutual aid equipment, and other items.

A second concern is the fact that in order to implement airtime billing, a central billing authority must be created to administer the billing system. This responsibility would be designated to the system manager. Or other State independent authority.

9.0 NEXT STEPS

To build a statewide communication system, Rhode Island must take decisive action to pursue a shared communication infrastructure that is accessible to all interested public safety agencies statewide. More importantly, to appropriate long-term funding commitment to implement the proposed network. The lack of action will deteriorate interest and fail to move the project forward.

The following steps will establish a firm direction for the future of a statewide radio network in the State of Rhode Island. These steps are necessary to ensure that radio communications will effectively support the delivery of public safety services well into the 21st century.

7. **Develop a strategy for system funding and finance**
   Successful multi-year migration to a statewide network will require significant investments in the system infrastructure. Identify appropriate sources of capital funding and finalize financing arrangements for the system.

8. **Identify additional 800 MHz spectrum**
   Work with the Region-19 RPC to identify supplementary 800 MHz channels that may be available to Rhode Island. Additional channels will allow the State to implement their system more quickly without having to wait for 700 MHz channels that will be available in the distant future.

9. **Institute a Multi-Agency Governance Structure**
   This formal decision-making body should be established to provide the required oversight and to guide the lead agency that will manage the construction and operation of the proposed network. A project manager should be selected to provide guidance of the selected vendors of the statewide communication system. The project manager would be directly responsible for implementation and would be the communications conduit to the governing structure.

10. **Finalize network design**
    To plan and support the final development of the new system, the State should seek participating agency input for the system design and the development of policies for the proposed network.

11. Competitive Procurement Process

The State should develop single/multiple Requests for Proposal [RFP] for equipment and system procurement by developing detailed functional specifications for the statewide communications network.

12. Obtain Outside Technical and Support Assistance

The State should seek outside specialized skills to assist the State's project manager in finalizing the technical design, the development of technical specifications, and to provide project management support.